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Memory and memory demands of very young children.

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MEMORY AND MEMORY DEMANDS OF VERY YOUNG CHILDREN

A Dissertation Presented

by

Hilary Horn Ratner

Submitted to the Graduate School of the
University of Massachusetts in partial fulfillment
of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 1979

Psychology

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awarded to Nancy Angrist Myers and Marvin W. Daehler

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HILARY HORN RATNER

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Dedication

To my husband, Stuart, and to my family, whose love and support made the attainment of this degree possible.

ACKNOWLEDGMENTS

The person I would like to thank foremost is the chairperson of my committee, Nancy Myers, for her assistance in this project and as mentor and advisor during my entire graduate career. Her guidance and instruction have been instrumental in my development as a professional and to her I will always be grateful. I wish also to thank Marvin Daehler who has been a great deal of help to me on this and other projects over the last five years. The contributions of my other committee members, Jim Chumbly and Grace Craig, have been valuable as well and to them I would like to express my appreciation.

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Finally, I would like to thank the mothers and children who gave their time to participate in the study. For truly without them, this project could not have been conducted.

ABSTRACT

Memory and Memory Demands of Very Young Children

(May, 1979)

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The primary purposes of this study were to determine the nature of and changes in early memory demands, to examine how young children respond to these demands, and to assess the relationship between memory demands and memory performance.

Ten children at each of two ages, 30 and 42 months, were observed in their homes for four, two-hour sessions. Conversations between mothers and children were recorded and certain memory demands were identified and coded. One type of memory demand involved the asking of questions, which were coded in terms of structure and content. Structure referred to the form of the question, either wh- or verification (yes-no), and content to the type of information dealt with in the question. There were two question-content categories: event and knowledge. Event questions were primarily coded in terms of the time period in which

the event asked about had occurred. Knowledge questions were concerned with information about objects, symbols, and routines. The second type of demand was providing information about memory or engaging the child in memory-related activities.

After the observational sessions had been completed, children participated in two memory tasks conducted in the laboratory which were designed to tap long-term memory. The child was shown a large empty dollhouse and in the production task was asked to name all the items possible which would be placed into two rooms of the house. After all items had been named, the verification task was begun in which the child was shown a series of objects and asked if each belonged in the rooms.

In general, mothers centered their conversations on present events and there were few changes between age two and three in the number or type of questions children were asked. At age three, children whose mothers had asked the highest proportion of event questions performed the best in both the production and verification tasks and children whose mothers had asked the highest proportion of knowledge questions performed the best on only the verification task. At age two, there were no overall relationships between memory demands and memory performance. Mothers gave little specific information to their children about memory at both

ages and there were few relationships between knowledge of memory and memory performance.

These results suggested that there was a relationship between memory demands and memory performance which provided preliminary support for Vygotsky's socio-historical theory of cognitive functioning. There was no evidence, however, that demands increased with the age of the child and thus could not account for the age-related increases in memory performance that occurred.

TABLE OF CONTENTS

ACKNOWLEDGMENTS	v
Chapter	
I INTRODUCTION	1
Soviet Perspective on Memory Development	4
Implications of Soviet theory	9
The Present Experiment	14
Memory demands	15
Relationship between memory demands and performance	19
Summary	24
II METHOD	26
Subjects	26
Procedures	26
Observations	26
Verification and production tasks	29
Transcribing	32
Coding	33
Question structure	33
Question content	34
Memory knowledge measures	40
Dependent measures and analyses	40
III RESULTS AND DISCUSSION	43
Overall Event and Knowledge Questions	43
Proportions of event and knowledge questions	48
Correct responses to event and knowledge questions	57
Event Questions	57
Proportions of event questions asked	70
Percentage of correct responding to event questions	73
Correlations among correct responses	
Interpretation of correlations among correct responses to overall event and knowledge questions and lan- guage ability	81
Knowledge Questions	86

Question proportions	87
Proportion correct	94
Implications of Findings from Observational Data	99
Verification and Production Measures	101
Overall performance on memory tasks	101
Correlations among production and verification responses	105
Relationships Between Memory Performance and Questions Asked at Home	110
Memory Performance and Proportion of Questions Correctly Answered	120
Interpretation of Relationship Between Mothers' Questions and Children's Performance	126
Relationships Between Memory Knowledge and Performance	131
IV SUMMARY AND CONCLUSIONS	141
Observational Findings	141
Relationship Between Home and Laboratory Measures	150
Future Directions	159
REFERENCE NOTES	168
REFERENCES	169

LIST OF TABLES

1.	Proportions of the Total Number of Questions Asked that were the Four Question Types	46
2.	Correlations Among the Proportions of Mothers' Speech Consisting of Questions of the Four General Types	49
3.	Percentages of Home Questions Answered Correctly by the Child	50
4.	Correlations Among Percentage Correct Responses to Four Question Types and Mean Length Utterance	54
5.	Percentage of Event Questions Asked of Each Child	59
6.	Significant Correlations Among the Proportion of Event Questions Asked of Particular Types	63
7.	Significant Correlations Among Proportion of Total Mothers' Speech Representing Various Event Categories	66
8.	Proportion of Event Questions Asked that Children Answered Correctly	71
9.	Significant Correlations Among Proportions of Questions Asked that were Answered Correctly at Age Two	75
10.	Significant Correlations Among Proportions of Questions Asked that were Answered Correctly at Age Three	76
11.	Proportion of Total <u>Wh</u> - and Verification Knowledge Questions of Each Type	88
12.	Significant Correlations Among Proportions of Mothers' Speech Representing Knowledge Category Subdivisions	91
13.	Proportion of Questions in Each Knowledge Category Answered Correctly	95
14.	Significant Correlations Among Percentages of Knowledge Questions Answered Correctly	97
15.	Verification and Production Performance	102
16.	Significant Correlations Among Verification and Production Dependent Measures	107
17.	Significant Correlations Between Proportion of Mothers' Speech Involved in Questioning and Memory Performance	112
18.	Significant Correlations Between Performance on Memory Tasks and (A) Proportion of Mothers' Speech Representing Event Category Questions and (B) Percentage of Questions Answered Correctly	115

19.	Significant Correlations Among Proportions of Mothers' Speech Consisting of Knowledge Category Questions and Performance on Production and Verification Tasks	116
20.	Significant Correlations Between Memory Performance and Percentage of Knowledge Questions Answered Correctly	122
21.	Significant Correlations Among Indices of Memory Knowledge and Memory Performance on Verification and Production Tasks	136

C H A P T E R I

INTRODUCTION

The development of children's memory abilities has been an area of primary research concern in the last 15 years (e.g., Flavell, 1970; Brown, 1975; Kail and Hagen, 1977). This increased interest in memory development has been due in part to the growing interest in cognitive processes that has occurred with experimental psychology. Although children's memory had been studied previously (e.g., Hunter, 1913, 1917), this recent upsurge in attention to children's memory primarily resulted from the application of theories, methods, and findings of cognitive experimental psychologists to developmental issues. The information-processing model of adult memory which has been predominant in cognitive psychology depicted memory as comprised of three structural components, sensory, short-term and long-term memory, and processes for controlling the flow of information through these structural components (e.g., Atkinson and Shiffrin, 1968). Much research was devoted to short-term memory abilities and the use of control processes, or strategies, to maintain information in short-term memory and transfer information to long-term memory. Developmental psychologists focused on the changes that oc-

curring in short-term memory and the control processes, or strategies. With age memory was found to improve and children were seen as becoming better able to plan, execute, and monitor memory strategies, which has been thought to at least partially account for increased memory performance. Ornstein (1978) notes that these interests are still visible in current research, although the study of children's memory has broadened in recent years. Memory development researchers have become concerned with representation (e.g., Kosslyn, 1978; Horn and Myers, 1978); retrieval processes (e.g., Kobasigawa, 1977); encoding (e.g., Kail and Siegel, 1977); cross-cultural influences (e.g., Cole, Gay, Glick and Sharp, 1971); constructive processes (e.g., Paris, 1978); and the influence of knowledge on recall and recognition (Chi, 1978; Perlmutter and Myers, 1976). Thus, a great deal of information has been obtained concerning the development of a variety of children's abilities important in memory functioning.

Recently, however, concerns have been voiced that past research in some ways has still been relatively narrow in its focus and that new questions and approaches for study are needed to further the inquiry into memory development (Brown, Note 1; Neisser, 1976; and Paris, 1978). Standard tasks used in memory research have often involved the learning of word-, picture-, or object-lists. These tasks re-

flect those that children face in school settings and are, therefore, of great interest; however, such tasks do not typically reflect the types of memory situations an individual encounters in his everyday life. Neither does performance on tasks conducted in the laboratory permit an examination of the processes involved in acquiring the abilities useful in everyday tasks or those observed in the laboratory for that matter. To a large extent we have found what develops, but we do not yet know how. Furthermore, emphasis on list-learning has greatly limited our understanding of preschool children's memory development. Such tasks are difficult to conduct with young children and those studies that do exist with this age range often are designed to investigate traditional questions and employ variations on standard procedures appropriate to the age range tested (e.g., Corsini, Jacobus, and Leonard, 1969; Brown and Scott, 1971; Rossi and Wittrock, 1971; and Goldberg, Perlmutter, and Myers, 1974). Currently, then, there is a growing interest in examining the development of memory abilities, especially in young children, which are important in naturalistic settings, and investigating the processes underlying memory development. The present study was aimed at beginning to bridge some of the gaps in developmental memory research by examining memory and memory demands in a naturalistic setting and evaluating the influence of social context

on memory development.

Soviet Perspective on Memory Development

Soviet perspectives on memory development have received much attention recently from American investigators who have become concerned with the factors involved in memory development (e.g., Meacham, 1977). Soviet psychologists have long viewed memory abilities as influenced by cultural context and emphasize that memory develops as a result of interaction with the environment. The study of child development in the Soviet Union was and still is largely motivated by Marxist doctrine as it was applied to psychology by L. S. Vygotsky and modified by his students (Leontiev and Luria, 1968). Marx proposed that man's mental life should be approached as the product of community life, and that consciousness has been from the beginning of time an historical product. Vygotsky was one of the first Soviet writers to recognize the importance of this proposition in developing a systematic, empirical Marxist psychology. Two basic propositions seem to emerge from his writings: (1) Human mental abilities (e.g., perception, memory, and attention) arise in the process and activity of cooperation and social interaction, and they cannot otherwise. (2) The nature and content of social interactions, which influence the mental process in question, are determined by

larger historical and cultural forces impinging on those interactions. Thus, mental processes are believed to be influenced by the needs and demands of cultural groups and by the place of a particular society in time. Although Vygotsky stressed the importance of cultural influences on cognition, he viewed development as a complex interweaving of both biological bases of behavior and socio-historical demands of an individual's culture.

Vygotsky's theory predicts differences in the cognitive abilities among various cultures at one point in time or within cultures over time. Vygotsky further proposed that various types of memory abilities would develop in response to particular demands of a culture. Thus, differences in cognitive abilities among cultures may reflect the degree of development and lie on a cognitive continuum. Cole and Scribner (1977) describe Vygotsky's theory (as modified by Leontiev) as posing several changes that memory abilities pass through in response to the demands of acculturation (i.e., acquiring a written and spoken language, increased urbanization and involvement in technological trades, formal education, and related experiences). Memory is proposed to occupy an initial, "natural" state, in the earliest periods of prehistory, and is described as involving no special intention to remember, no special activity to store information, and no special activity to retrieve

information. Events are somehow "imprinted" in memory, and may be accurately retrieved at some later point, not necessarily at the proper time. If, however, a new situation occurs which is linked in some way to the past, remembered event, recall of the past may flow forth. Movement away from "natural" memory occurs first when an intention to commit material to memory emerges and secondly when strategies are devised to retrieve information when desired. Development is seen as progressing in two ways: first external, then internal devices are created for aiding in the storage and retrieval of information. External aids might include a notch in a stick, knots in a rope, or a string tied on the finger. These external physical aids were also seen as leading to universally applied sign systems of written languages. Internal memory aids involve thought processes and depend largely upon the internalization of speech. Primitive man, then, is seen as primarily relying on natural memory and occasionally external memory aids, while literate man remembers through writing systems and internalized memory aids. These changes, then, occur primarily as a result of the evolution of spoken and written language and the functions these systems hold within particular societies. Thus, for example, people who did not have or did not have access to a written language were thought to have developed systems of tying knots in ropes

to signify important information or to have constructed the lyrics of historical poems in certain ways to remember and pass from generation to generation. The needs and demands of the society are seen as influencing what cognitive abilities arise within that society.

Although cross-cultural studies of cognition and memory have been conducted and lend support to Vygotsky's theory at some levels (Luria, 1976; Cole and Scribner, 1977), the primary evidence used to support his ideas came from developmental research conducted with children. Vygotsky and Leontiev believed that development of the individual within a particular society could be used to understand development of cognition across cultures or time. Vygotsky saw the internalization of culturally produced sign systems (i.e., language) as bringing about tremendous transformations in behavior and as bridging early and later forms of individual development (Vygotsky, 1978). Thus, changes in memory that occur as a result of evolving sign systems over the course of human history were thought to parallel those that occur in an individual's lifetime given that he develops within an acculturated society. Indeed, Leontiev found that preschool children do seem to depend upon their natural or involuntary memory and do not benefit even from external memory aids. Slightly older children were found to successfully rely on external aids but unable to effective-

ly use internal aids. Finally, even older children could utilize arbitrary, internal symbols to mediate memory performance. Similar results supporting this general course of development have been found by other researchers as well (e.g., Flavell, 1970; Flavell, 1977; Myers and Perlmutter, 1978; Myers and Ratner, in press). These findings were used as sufficient evidence to support Vygotsky's theory of socio-historical cognitive development.

Vygotsky's theory, then, not only attempts to account for differences and changes in cognition in a socio-historical context, but also addresses how individuals develop cognitive abilities within their own lifetimes. Thus, one important implication of Vygotsky's theory is that within a given society the mechanism of individual developmental change is also rooted within the demands of that society. It is important to note that the demands of a culture may not influence the development of cognition by directly shaping cognitive abilities. Instead, a child may develop certain abilities which then influence those people in the society with whom the child interacts to make demands which bring about the development of other abilities. The demands of society, then, may occur in response to the development of certain abilities of the child, which occur less so or not at all in response to cultural influences. Thus, the child may play a mediative role in his own cognitive devel-

opment, rather than being solely influenced by the demands of society. From what can be gleaned from translations and summaries of Soviet work, however, it appears that not even Soviet psychologists have really adequately tested the implications of Vygotsky's theory for an individual's development. Whether Vygotsky was correct to emphasize the influence of societal demands at all on cognitive development is still an open question, and we must still look to answer the more specific question of what processes control memory development.

Implications of Soviet theory. What, then, are the specific implications of these propositions for the development of memory? Clearly, the child's social interactions will be considered central to his development of memory skills; and because children in our society, especially very young children, spend most of their time interacting with their mothers, mothers will be the most likely sources of stimulation for memory growth. Thus, according to Vygotsky, in order to understand the development of memory, we should be interested primarily in the content and structure of the interactions between mothers and children.

While Vygotsky is not very specific about what might be particularly important in the child's interactions with his social environment, later writers such as Yendovitskaya

(1971) and Smirnov and Zinchenko (1969) see memory goals and means for attaining those goals arising from social interactions as most crucial to development. Memory processing is seen as becoming more and more goal-oriented with development. For children before the age of three, memory is described as unintentional or involuntary, i.e., the child remembers without setting remembering as a specific goal for himself. Memory seems to occur in the context of play, comprehension, or daily events. Two different experimental approaches have been followed based on these ideas (Yendovitskaya, 1971). One involves varying how the child interacts with certain materials and then asking him unexpectedly to recall that material. He may be required to look at a series of pictures, to group them together in some way, or to tell a story about them. Children who group the pictures or tell a story about them are expected to recall more when asked than those who only look at the pictures. The rationale for this expectation is that the child who has been more active in his interaction with the material, and has generated more information from his own knowledge base in order to conduct the more detailed activity, remembers the information better. Alternatively, the child may have attended to more aspects of the task and has a greater probability of remembering the correct information. The important variable for memory, then, is the

quality of activity undertaken with information and it is this activity which primarily determines what will be remembered by very young children. This approach is closely aligned with the levels-of-processing perspective in this country (e.g., Craik and Lockhart, 1972).

The other line of inquiry consists of examining memory in varying contexts. The nature of the child's activity is again viewed as central to memory performance, but here the activity is embedded in and determined by a larger goal. Less emphasis is placed on analyzing specific activities and more attention is directed toward defining different global contexts in which remembering occurs. For example, children have been asked to remember information during standard laboratory tasks, during play, and during practical activity (i.e., carrying out some task). More meaningful contexts, such as play and practical activity, have been found to help children remember more effectively, presumably because the goal of, and means for, remembering are embedded in that activity. Again, remembering is not the goal of the activity itself but is determined by the larger context in which it occurs.

With increasing age children become more goal-oriented, and eventually memory is described as being voluntary, i.e., remembering is defined as a goal in itself, and the means emerge for producing efficient memory on one's own

without having to rely as heavily on context. The means for remembering, or mnemonic strategies, are seen as somehow deriving from the activities which were not in themselves intended for memory, such as play or practical activities. For example, a child may be told to put away his toys so that all the puzzles are together, all the cars are together, and all the books are together. His mother may then ask him to find particular toys from time to time and he may discover the grouping organization. If he is given new toys, he may deliberately incorporate them into the grouping scheme in order to remember where they are. He has in effect learned about the usefulness of categorizing items in order to remember them, from an activity which was not originated for the purpose of remembering.

Parents are seen, at least in part, as instrumental in bringing about the shift from involuntary to voluntary memory. The child begins to be presented with tasks requiring him to remember specific kinds of information which results in acquiring skills useful for memory within the routines of his daily life. Presumably as the child grows older parents increase their demands and further facilitate the growth of memory abilities. The activity of the child determined by the demands of the social context is seen as the primary process stimulating the development of memory. Herein lies the importance of social interactions for the

development of mental functioning, in general, and memory in particular.

The Present Experiment

The role of memory demands in memory development was examined in the present investigation to evaluate the importance of social context in memory functioning. The nature of mothers' memory demands, differences in demands as a function of the child's age, and how well the demands were met were the central areas of study. Memory demands may take many different forms, such as requiring the retrieval of information, storage of information, giving instructions, and providing memory-specific information about strategies that could be used to retain and retrieve information or general knowledge of how memory works. In the present study, memory demands were limited to the first and last of these: demanding the retrieval of information and providing memory-specific information. The reasons for this choice are described below. Trained observers went to the child's home and conversations between mothers and children going about their daily routine provided the basis for examining memory demands. Estimates of the nature of the primary, day-to-day social interactions were obtained by observing the child in a familiar, meaningful setting. Although it has been shown that verbal interaction increases between mother and child in the laboratory when the mother

believes she is being observed (Graves and Glick, 1978), it was assumed that the quality of the observed interaction at home would closely approximate the quality of interaction on a day-to-day basis when mothers and children were not observed. Young preschool children who were two-and-a-half and three-and-a-half years of age were selected to participate in the study. Younger children are less likely to attend nursery school or spend a great deal of time with peers. The mother, then, is more likely to be the primary social contact and thus mothers' memory demands would comprise the greatest proportion of all memory demands placed on the child. The nature of these demands, then, would provide the most accurate picture of the types of demands the child encounters. Moreover, as noted earlier, less is known about very young children's memory development and thus information concerning this age range is sorely needed. The search for relationships between maternal behaviors and children's cognitive and language functioning is not new (e.g., Clarke-Stewart, 1973; White and Watts, 1973; Nelson, 1973; Snow and Ferguson, 1972; Greenfield and Smith, 1976; Carew, Chan, and Halfar, 1975). While some of the behaviors coded in those studies are relevant to memory development, the questions asked, the specific measures used, the data analyzed, and the conclusions arrived at, were not motivated by the present per-

spective and are therefore not very informative.

Memory demands. Memory demands occurring in conversation that require the retrieval of information from memory consist of asking questions. Questions have been found to comprise approximately 15 to 36 percent of total mothers' speech to young children (Holtzman, 1972; Cross, 1977; Newport, Gleitman, and Gleitman, 1977). Because asking questions appears to occur fairly frequently in mothers' speech, this type of memory demand was thought a good one for study in this investigation. Furthermore, even children at the very beginning stages of language acquisition appear to discriminate questions from statements and to discriminate wh-questions from yes-no questions (Ervin-Tripp, 1970; Crosby, 1976; and Horgan, 1978) because different types of responses are provided to each type of mothers' utterances. By two-and-a-half and three-and-a-half years of age, then, there is little doubt that children know they are being asked to retrieve information. In addition, the different forms of questions require different degrees of memory processing and thus represent varying levels of demands. A wh-question asks who, what, when, where, why, or how and requires the retrieval of a specific piece of information as an answer. A yes-no question asks only for the verification of a proposition

and requires a response of either yes or no. In the first case, recall is required and in the second, recognition. While it is not always true that recognition is a less difficult task than recall (e.g., Tulving, 1968; Tulving and Thomson, 1973; and Watkins and Tulving, 1975), in general it has been found that information is more easily recognized than recalled (e.g., Crowder, 1976; Kintsch, 1970; Klatzky, 1975; Anderson and Bower, 1974) and this is true for children as well as adults (e.g., Myers and Perlmutter, 1978). Therefore, it would be of interest to know if the incidence of recall and recognition demands changes with age and if the child is more successful in answering yes-no questions than wh-questions. Finally, the questions that are asked by mothers obviously differ in terms of what is being asked. Types of information requested for retrieval may vary with the child's age and children may be more successful in responding to certain types of questions depending on content. For example, mothers have been found to predominantly center their conversations on the here-and-now (e.g., Phillips, 1970, Moerk, 1972) by limiting their discussions to what the child can see and hear, what is about to happen, or what has just happened. Certainly if the mother asks a question about an ongoing or immediate-past event, the child must retrieve some information to answer correctly; however, it

may be relatively easier to do so if the queried event has been recently experienced and/or if there are cues present to evoke remembering of that event, than if the event had been experienced earlier in the day, two weeks ago, or in the previous year. Thus, it will be of interest to know how often children are asked about remote and immediate past events in comparison to present or ongoing events. Relative ease of answering questions focusing on objects, instead of events, may also vary with the type of information requested. For example, providing the name of an object may be less difficult than remembering its characteristics or its location.

Interest in the extent to which mothers provide memory specific information is motivated by the recent concern with metamemory (e.g., Flavell and Wellman, 1977), a term coined by Flavell (1971) referring to an individual's knowledge and awareness of anything pertinent to memory functioning. For example, a person displays metamemory if he knows certain things are easier to remember than others or if he knows how to make sure a telephone number or a list of words will be remembered. Flavell considers the acquisition of metamemory central to the development of memory in general. The utilization of certain strategies has, in fact, been linked to higher levels of recall in children. One of the earliest demonstrations was provided by Keeney,

Cannizzo, and Flavell (1967). First-grade children were presented with a serial recall task in which, after a delay period, they were to point to a sub-group of pictures from a larger set in the same order as an experimenter had pointed to them. Children who were observed to spontaneously rehearse the picture names during the delay period (that is, repeat the names over and over to themselves) recalled the picture sequences better than those who did not rehearse. Children who did not spontaneously rehearse could be taught to do so, however, and when they did, their level of recall improved to the level of spontaneous rehearsers. With age, children have also been observed to increase their utilization of strategic processes such as rehearsal (e.g., Flavell, Beach, and Chinsky, 1966). We know that children's memory improves with age, that memory can be increased when strategic processes are used, and that strategy use also increases with age, which leads to one conclusion that the age-related improvement in memory is due to the increased utilization of strategic processing (e.g., Flavell, 1970; Liberty and Ornstein, 1973; Hagen, Jongeword, and Kail, 1975; Hagen and Stanovich, 1977; Kobasigawa, 1977; Moely, 1977). This proposed relationship has not been conclusively established, however, and is currently under some debate (e.g., Huttenlocher and Burke, 1976). Nevertheless, Flavell believes, then, that in order

for the child to use particular memory strategies, he must know they exist, he must know about their potential usefulness, and he must know when and how to use them. In short, the child must acquire metamemory. Although Kreutzer, Leonard, and Flavell (1975) have shown that children from kindergarten through fifth grade have acquired a great deal of knowledge about memory and Wellman (1977) has shown that even three-year-olds can demonstrate rudimentary understanding of memory-relevant variables, how this knowledge is accrued is unknown. Flavell and Wellman (1978) speculate that "parents, teachers, and others may frequently set various types of storage and retrieval tasks to the child or engage in efforts themselves under the child's watchful eye. At times, these significant others may actually provide a model of various memory behaviors." Again parents are proposed to be influencing agents in the development of memory. To assess whether mothers do indeed provide information about memory and remembering, the conversations between mothers and children were examined for occurrences in which information about memory was conveyed.

Relationships between memory demands and performance. Although it is informative to know what the nature of mothers' memory demands is and how these demands might change with the age of the child, the central issue is whether these

demands influence memory performance and development. Are varying levels of memory demands related to varying levels of memory performance? That is, do mothers who make many memory demands or certain types of demands have children who have good memory abilities? To provide evidence that is consistent with the Soviet view on the role of demands made within a social context in cognitive functioning, a relationship between mothers' demands and children's memory performance must be found. To determine if this relationship exists, children in the present study participated in memory tasks, designed to tap longterm memory abilities, after the observational sessions had been completed. Children were presented with two memory games: production and verification. In the production task children were asked to name all the things they could which would be found in two rooms of a house. After the children had named as many items as possible, the verification task was begun in which a series of miniature replicas of objects, half appropriate room items and half inappropriate, were given to the children and they were asked if each belonged in the room. These tasks were chosen for several reasons. Previous research has demonstrated that two- and three-year-old children uniformly do very poorly in tasks which require recall for a list of objects or pictures they have just seen and conversely, do uniformly well on tasks

requiring them to indicate simply whether the pictures or objects have been seen at all (Myers and Perlmutter, 1978). Thus, in one task most children do poorly and in the other, most do well. To evaluate individual differences in performance and relate them to individual differences in mothers, a task is needed which allows a wide range of performance and differentiates children. Presumably children would be likely to know what objects are found in rooms of their homes and there is really no limit on the number of items that could potentially be named. Thus, information well known to the child, previous to his coming to the laboratory, was involved in the task and a wide range of responses was possible. The production task was also chosen because children were not required to encode any new information and only the retrieval of information was demanded. Finding a relationship between mothers' demands and children's memory performance might be more likely, therefore, since mothers' memory demands required the memory ability that the memory task also required, namely, retrieval. Furthermore, if a relationship were found between memory retrieval demands and memory retrieval, it would suggest that specific memory demands are linked to memory performance in specific ways. It was also thought that the questions in the production task closely resembled those which might be asked by mothers at home. That is, mothers would

be more likely to test the child's knowledge of objects in his world than his recollection of a list or arbitrary words or pictures, so that a stronger relationship between memory demands and memory performance might be found if a task tapping longterm memory rather than shortterm memory was used. The verification task was primarily used to compare what the child knew to what he could retrieve in the production task. If children retrieved little information even though the task was concerned with knowledge presumably very familiar to them, difficulties in retrieving the information could be responsible, or the information could be truly unfamiliar, contrary to expectations. Performance on the verification task was used to determine whether the production task tapped familiar knowledge. Finally, the two memory tasks were used to determine if mothers' demands were related equally to production and verification abilities.

Performance on the production and verification tasks should help to answer questions concerning the role of metamemory in memory development. If metamemory is assigned a primary role in the development of memory, then knowledge about memory should influence memory performance. That is, children who have acquired a great deal of information about memory should presumably perform better on memory tasks than those who do not know as much. Support

for this relationship, however, has been difficult to find, at least for school-aged children (e.g., Moynahan, 1973; Kelly, Scholnick, Travers and Johnson, 1976; Salatas and Flavell, 1976; Flavell and Wellman, 1977). For example, Moynahan had first, third, and fifth grade children recall a list of categorized and uncategorized words. Each child was given two prediction tasks, one before recall and one after. In one task, children were asked to predict whether categorized picture lists would be easier to recall than uncategorized lists and in the other task, children were asked to predict whether an organized sequence of colored squares would be easier to remember than a random sequence of squares. Children in both tasks were then asked to explain the reasons for their predictions. Correlations between recall performance and the prediction and explanation scores were calculated. Although the correlations were positive, none reached significance. In order to further evaluate the relationship between metamemory and memory performance, then, in this study the number of times both mother and child demonstrated knowledge of memory was correlated with performance in the two memory tasks. This approach differed from previous research in several ways and thus may yield different results. When the nature of the relationship between metamemory and memory performance has been investigated,

episodic tasks requiring the use of short-term memory abilities have been employed to measure memory performance. In contrast, the production and verification tasks were designed to tap long-term memory performance. Furthermore, in previous research, the child's metamemory has been estimated from answers given to questions about memory situations. In this study, metamemory was inferred from the overt activities of mother and child.

Summary

The present investigation was undertaken to examine memory development in the context of social interactions, in order to provide empirical evidence supporting Vygotsky's socio-historical theory of cognition. To determine the role mothers play in their children's development of memory, the nature of memory demands placed on children was assessed and the relationship between memory demands and memory performance was explored. The specific memory demands examined were questions mothers asked their children requiring retrieval of information and any instruction they may have pertinent to the functioning of the memory system. Memory performance was assessed in two tasks requiring retrieval of information from long term memory. These two sets of data were then correlated. The unique aspect of this research is the examination of the rela-

tionship between quite specific maternal behaviors and memory abilities of the child, to understand the process of memory development.

CHAPTER II

METHOD

Subjects

Five boys and five girls at each of two ages, 30 and 42 months, and their mothers participated in this study. Potential subjects were located from local birth records and their mothers were sent a letter outlining the project. Mothers were then telephoned and the observational sessions were scheduled if the mother was interested in participating. Mothers were paid three dollars for each of the observational sessions and for one visit to the university. The mothers and children were white, middle to upper middle class residents of Amherst, Massachusetts, and surrounding towns. Mothers' educational level ranged from 12 to 20 years, with a mean level of 14.3 years.

Procedures

Observations. Four, two-hour sessions within a two-week period were scheduled in the child's home. Mothers were simply told that the study involved the examination of what mothers and their young children do together and say to each other while they are at home going about their daily

routines. No explicit mention of interest in memory development or performance was made. One of five female observers went to the child's home for all sessions and recorded the conversations between mother and child on a portable, cassette-tape recorder which was battery operated. In addition, a written record was made of as much of the conversation as possible as well as a description of ongoing activities. This was done to provide an account of the immediate context from which to appropriately interpret the utterances, to aid in transcribing, and to serve as the only record of the conversation in cases of taping failure which occurred on occasion. Mothers were urged to go about their normal routine and ignore the observer's presence as much as possible. If the child engaged the observer in conversation, she tried to respond pleasantly but as little as possible to discourage further interaction. Most mothers and children within the first observation session seemed acclimated to the presence of the observer and interest in her declined. Observers followed mother and child wherever they went throughout the home, sometimes outside, or even to the store. Mothers were encouraged to choose a time for sessions when siblings or the child's friends would not likely be present; however, this was not always possible. Nevertheless, eight hours of observation time were scheduled primarily because it was expected that mothers and children

would not be in constant contact with one another and thus the large amount of time spent with each pair allowed more than adequate sampling of behavior.

At the close of the observations, mothers were provided with full details of the purposes of the study and a time was arranged (within another two-week period) for the mother and child to visit the University Child Behavior Laboratory to play a memory game.

Before the observers visited children's homes, they participated in a training session. A mother and child came to the university and played together in a comfortably furnished room for about 45 minutes. Both a video and audio tape recording were made of the interaction. The videotape was then shown to the observers who recorded the conversation and activities of the mother and child as if they were actually observing them. Each observer then completed a transcription of the play session from the tape recording, which had been made while the mother and child were actually playing together, and from her own written notes. After each of the five transcriptions had been completed, one transcription was chosen as the standard and all others were compared to it. Every utterance of mother and child in the transcription chosen as the standard was compared to each utterance of mother and child in the other four transcriptions. This measure confirmed that the observers were

recording the conversations and activities of mother and child similarly. The percentage of both mother's and child's utterances which matched the standard in meaning was calculated for each of the four transcriptions. Because we were not specifically interested in obtaining an exact record of the language spoken, slight variations in form, but not content, were considered as appropriately matching the standard. The percentages of agreement ranged from 88.5 to 96.3.

Verification and production tasks. A large unfinished dollhouse constructed of plywood was placed on a low table in a small experimental room. Next to the table was a book shelf holding two boxes containing the objects used in the verification task, as well as a tape recorder used to record the session. Each box contained miniature replicas of objects which could be appropriately placed in a kitchen or a bathroom as well as items which would not be commonly found in each room. There were 12 items for each room which had been judged to be highly specific to that room. Positive kitchen items were coffee pot, dishwasher, rack with cooking tools, eggbeater, plate, stove, cereal boxes, rolling pin, frying pan, refrigerator, toaster, knife and fork. Positive bathroom items were shower, bathtub, toilet, shampoo, clothes hamper, scale, sink, toothbrush, water toy, sponge, washcloth and toilet brush. In addition to objects which are found in these rooms, 12 items were presented which would

not be found in the kitchen or bathroom. Negative kitchen items were sandbox, piano, lamp post, bed, slide, car, showercap, blanket, couch, toothpaste, elephant, and razor. Negative bathroom items were highchair, desk, picnic table, birdhouse, lion, ketchup, crib, barbecue grill, rake, cookie jar, television, and bicycle.

After the child was acclimated to the laboratory setting, (s)he and the child's mother were invited to play the game in the nearby room already described. The mother sat in a chair next to the dollhouse and the child was asked to sit or stand in front of the house with the experimenter to his or her side. The child was shown the empty dollhouse and for one-half of the subjects the room designated as the kitchen was pointed out and named, and for the other half, the bathroom was so identified.

Following this introduction to the dollhouse, the production task was initiated in which the child was asked to name things which could be placed into the room to make it a kitchen (or bathroom), would be in the kitchen (or bathroom), would belong in the kitchen (or bathroom), etc. A variety of phrases was used to elicit appropriate items to maximize the likelihood that children would understand what they had been asked to name. If the child did not begin to respond, the experimenter asked the question again or if the child gave a response and then stopped, the ques-

tion was repeated. The production task was terminated for a particular room when the experimenter had repeated the question three times with no further response from the child. The experimenter recorded all items given by the child.

Once the production task had been completed for the first room, the verification task appropriate to that room was begun. The experimenter showed and named the items, described earlier, to the child and (s)he was asked if they belonged in that room. For example, if the child had been asked to name kitchen items first, (s)he would be presented both the positive and negative kitchen items and asked if that item would be found in the kitchen. Once a verbal response had been given, the child was asked to place the object where (s)he thought it should go in the house. This procedure was adopted because some children in pilot testing had been observed to place the object in a room which was discrepant with the verbal response given. Both verbal and nonverbal responses were given. The entire production and verification task procedure was then repeated for the other room. The mother was asked to complete a check-list indicating if the objects presented to the child were found in his home and if so where they were located. Most items were familiar to all children and there were very few which were located in a different place in the child's home from

the location chosen in the task. The dependent measures of interest for the verification task included the total number of correct responses given, the number of correct responses to "yes" questions, the number of correct responses to "no" questions, and the latencies to respond to each type of question. The primary dependent measures for the production task were the total number of responses given, the times necessary to produce the responses, and the number of times the experimenter repeated the question eliciting production response (prompts).

Transcribing. After the observation sessions had been completed, all tapes and written records of the sessions were transcribed by one of six transcribers. Only one of the five observers also served as one of the six transcribers. All six transcribed the first session of one subject's data to establish reliability in a manner similar to that used to establish reliability among observers in the training session. One transcription was chosen to be the standard and all others were compared with it. Percentages of agreement ranged from 85.4% to 96.0%. The discrepancies almost always occurred in the few places when the tape recorder had been too far away for the source of conversation during taping or when background noise made it difficult to determine what was being said.

Coding. The coding scheme was developed on the basis of two protocols and then refined when instances occurred which were judged important but did not fit into the code. When changes were made all protocols were rescored. Half the data of one of the two-year-olds was used to generate the code and then it was applied to the other half in order to judge its acceptability. Changes were made and then the code was used to score one of the three-year-old's data. Again changes were made and the code was reapplied to the original two-year-old's protocol. That basic code was then used to score the data of the remaining subjects making minor adjustments when necessary.

Question structure. Questions asked by the mother and the child's responses to these questions were the major utterance types of interest. Two aspects of the questions were coded: structure and content. Structure referred to the form of the question. That is, did the question require retrieval of a particular piece of information or was the child only asked to verify a proposition by answering yes or no? The distinction of interest here is between the demanding of recall or recognition of information. The first type of question was labeled a wh-question since most questions of this type ask for who, what, when, where, and why. The second type was labeled a verification or y-question. The coding of these two types of questions were interpreted in

terms of the actual implied demands of the question. Some wh-questions asked are not actually done so with the expectation that information will be retrieved in response to them. For example, "Why don't you close the door?" is not really a request for the motivation behind not closing the door, it is an instruction or request to close the door and as such would not have been coded as a wh-question. Furthermore, some questions taking a verification form were actually requests for information other than a yes-no answer and thus were coded as wh-questions. For example, "Can you count for me?" is really a request for the child to recall a sequence of numbers and not a request as to whether the child can indeed count. Every question of interest, then, was coded as to whether it was a wh- or y- question and whether the child answered correctly or not.

Question content. The other aspect of questions which was coded involved the kind of information with which the question dealt. Two large categories of questions were derived, event and knowledge, and many further subdivisions of each of these categories were made. Every question was coded as belonging in the event or knowledge category, in general and a subcategory, in particular. Event questions were defined as those questions referring to activities or mental experiences of people in certain time contexts. The subdivisions made in this context were primarily in response

to when the events occurred. Presumably it would be more difficult to retrieve information about events occurring some time in the remote past as opposed to those occurring at the present time and the demand placed on memory functioning would be greater in the first than second case. A list of the event-category question subdivisions and a prototypical example of each in its wh- and v- form are given below:

- 1) ONGO--ongoing or present events (What are you doing?
Are you playing with your cars?)
- 2) PAST IMMEDIATE--very recent past events (The child had just dropped a dish. What did you do?; Did you break that?)
- 3) FUTURE IMMEDIATE--events which will happen momentarily (The child has a crayon in his hand. Where are you going to put the crayon?; Are you going to color in your book?)
- 4) FUTURE--events occurring at least 15 minutes in the future (Where are we going tomorrow?; Are we going to see Grandma this afternoon?) [Questions about future events were included because it was assumed that the child had been previously told of the future event or knew that it would occur because it had repeatedly happened in the past.]
- 5) WITHIN SESSION--events occurring at some past time (at

- least 15 minutes before the question is asked) during the current observation session (Where did you put the paper you had?; Did you put your book in the toy box?)
- 6) TOTAL SESSION--events occurring some time during the period in which the observations are first begun and ended, but not on the current day of observation. (The day before the current observation, the child was also observed. What did we do at the library yesterday? Did we get books out of the library yesterday?)
 - 7) BEFORE SESSION--events occurring before the observation session ever began (Where did we go on vacation last summer?; Did we see big waves at the beach last summer?)
 - 8) OTHER REMOTE PAST--events occurring some time in the past and not on the day of observation, but the exact time is unknown to the observer. These events, if time of occurrence was known, would be scored as before or total session.
 - 9) HABITUAL--events which occurred more than once before or represent the past, present and future state of affairs (What do you always do with Daddy in the morning?; Do you brush your teeth with Daddy in the morning?)
 - 10) FICTIONAL PAST--events involving fictional characters which are phrased in the past tense or the child knows from some past knowledge of the character's activities (What did Mickey Mouse do when the little people found

him?; Did Mickey Mouse try to get away when he was found?)

- 11) CONDITIONAL--events which follow the form, "if or when x happens, y happens," and have usually occurred before, providing the child with the knowledge concerning the conditions under which the event could or would happen again (If you touch that again, what's going to happen?; Am I going to spank you, if you touch that again?)
- 12) REASON--the reason behind an event's occurrence (Why did you do that?' Did you break that because you're angry?)
- 13) CLARIFICATION--requests for repetition or clarification of what the child has just said (What did you say?; Did you say you hurt yourself?)
- 14) OTHER--any events not falling into the above categories.

The questions coded in the knowledge category were in some ways more diverse in nature than those in the event category. Overall, the questions dealt with more abstract information about objects and symbols, but some questions were concerned with episodic, contextual knowledge as well. A list of the knowledge-category question subdivisions and a prototypical example of each in its wh- and y- form are given below.

- 1) OBJECT AND ANIMAL NAMES--(What's this? (referring to a picture of a dog); Is that a shoe?)

- 2) PERSON NAMES--(Who's this?; Is this Hilary?)
- 3) OBJECT LOCATIONS--(Where are your ears?; Is your bike in the garage?)
- 3) ACTIONS--the functions or actions of objects (What does an airplane do?; Does an airplane fly in the sky?)
- 5) OBJECT PROPERTIES AND STATES--(What color is an apple?; Is the television broken?)
- 6) AGE--(How old are you?; Is John a year old?)
- 7) CATEGORY MEMBERSHIP--(What kind of a dog is this?; Is a cucumber a vegetable?)
- 8) SOCIAL ROUTINE--information about what people are expected to say or do in certain social interactions or situations (What do you say to the lady?; Do you say thank you?)
- 9) OBJECT COMPARISON--comparing two objects on any one dimension or in general (What do you have that's like this toy?; Is your teddy bear brown like that one?)
- 10) OBJECT PRETENDING--information concerning objects used in play sequences (What's that? (referring to a block of wood that the child is moving back and forth); Is that a truck?)
- 11) PERSONALIZED OBJECT KNOWLEDGE--objects or people known to the child from a personalized episodic context (What kind of shoes do you want from the store?; Do you know Julie, the one with the glasses?)

- 12) OBJECT-COUNT--the number of objects in a particular set (How many are there?; Are there three there?)
- 13) COUNTING ROUTINE--a sequence of numbers not necessarily referring to a particular set of objects (Can you count for me?; Does it go 1-2-3?)
- 14) INFERENCES--putting pieces of information together and arriving at a conclusion (If you're a crab and I'm your mommy what does that make me?; If I'm taller than you, am I older than you too?)
- 15) GAMES--any information dealing with a game situation. If the information asked for can be coded according to other categories as well it is also coded in that category (What are you playing?; Are we playing "bora-bora?")
- 16) SYMBOLS--information about letters, numbers, or words (What does this say?; Is that an "n?")
- 17) VISUAL OR AUDITORY MATERIALS--repetition of or information about songs, stories, television, etc. (How does the song go that Donny sings on the record?; Is that the story about the three little pigs?)
- 18) NON-VERBAL ACTIONS--(How do you do a cartwheel?; Is this how you paste the picture on?)
- 19) OTHER--any other questions not fitting the above categories)
- 20) PAST--all questions scored as belonging to other knowledge categories which referred to objects or persons

in a past context. No distinctions were made between wh- and y-questions because few instances of this category occurred. (What was the name of the person who came to see us last night?; Was the car that Sally drove yesterday, yellow?)

- 21) FUTURE--same as above, except objects or persons discussed were placed in a future context. (What color is your costume that you're going to wear tomorrow; Is the girl who's coming to visit named Sally?)

Memory knowledge measures. Memory knowledge was measured in two ways for both mother and child. First, how often the words "remember" and "forget" were used and whether these words appeared in questions, statements, or instructions were scored. Second, specific mention and/or demonstration of useful memory strategies, how memory works, and what memory is were noted.

Dependent measures and analyses. After all utterances of interest were coded, the frequency of occurrence of each type across all four days of observation was counted. Preliminary inspection of the data revealed no consistent patterns over days and thus analysis by days did not appear to be warranted. Further, some types of questions occurred infrequently, which made pooling the data necessary. These frequencies were then divided by both the total number of

wh- and v- questions asked in each of the two large categories. These proportions were the primary dependent measures. Analyses conducted involved examining age differences in the occurrences of these question types and correct responses on the part of the child. Correlations were also calculated at each age among the home dependent measures to determine consistencies among asking and answering the various question types. Correlations were also calculated between the home measures and performance on the production and verification laboratory tasks.

The number of times mothers and children conveyed information about memory and the number of times mothers and children used the words remember and forget were counted. Age differences in the occurrence of these variables were calculated and correlations between the memory-knowledge measures and memory performance were computed.

CHAPTER III

RESULTS AND DISCUSSION

The amount of behavior recorded for analysis in this investigation was fairly large for an observational study. Thus measures of behavior in general were thought to be relatively stable for each child. For certain measures of behavior, however, the events recorded did not occur across all children or occurred infrequently, rendering interpretation of these results only suggestive. When this occurred, the analyses affected were noted. Furthermore, for some measures variability among subjects was quite high so that differences between groups which appear to be significant may not be. In some cases, nonsignificant differences were in fact larger than those found to be significant. All differences which were significant, however, were reported.

The two dependent measures involving questions were proportional measures. The frequency with which particular question types were asked was divided either by the total number of questions asked over the four sessions or by total mother's speech. Mother's speech was defined as the number of complete or meaningfully incomplete sentences which the mother spoke to the child over the four sessions. Both

measures were calculated because potentially different results could be obtained. For example, if a mother asked her child very few questions overall, but nevertheless spoke to the child a great deal, then the proportion of all questions asked which were of a particular type might be high, but the proportion of all utterances spoken which were of a particular question type would be quite low. All analyses involving question data were conducted on both dependent measures. In general the analyses did yield parallel results. The results of the analyses conducted will be reported for one dependent measure. When discrepancies in results occurred, they will be noted.

In all analyses involving age differences between the two groups of children, differences in behavior due to the sex of the child were also examined. Overall, very few sex differences occurred and those that did, did not form a consistent pattern. As a result, the effect of this variable will not be discussed further.

Overall Event and Knowledge Questions

Proportions of event and knowledge questions. The memory demands that are of primary interest involve the structure and content of questions which mothers ask their children. Mothers spent much time questioning their children's knowledge of objects, symbols, and events which they expected

them to know and remember. For two-year old children, 23.5% of their mothers' speech involved questions of these types and for the three-year-olds, this amount was 20.9%. The mean numbers of utterances spoken to two- and three-year old children (total mothers' speech) were 1841.1 and 1552.6, respectively, and did not differ significantly. Thus, the percentage of speech involved in questioning was the same for each age group and did not increase as might be expected. There were changes however, in the types of questions asked at each age. Knowledge queries comprised 38.5% of the total questions asked of two-year olds but only 30.4% of the questions asked three-year olds ($F(1,19) = 3.65$ $p < .07$). Conversely, queries for event information comprised 61.5% of all questions asked of two-year olds and 69.6% of all questions asked three-year-olds. When the percentage of total mothers' speech consisting of each question type was considered, however, these proportions did not change with age. For two-year olds, knowledge questions comprised 9.3% of total mothers' speech and event questions accounted for 14.2%. For three-year-olds, the comparable amounts were 6.8% and 14.1%.

Regardless of whether question types are considered as a proportion of total questions asked or of total mothers' speech, many more event than knowledge questions were asked of both two-year-olds ($t(9) = 4.78$, $p < .001$);

and three-year-olds ($t(9) = 5.63, p < .001$). Apparently, mothers were more interested in obtaining information concerning the activities of the child and those around him than knowledge abstracted from daily encounters. The forms these questions took, however, varied with the question content. Mothers varied their demands to recall and recognize information in response to whether they asked questions dealing with events or knowledge. Recall of information was required when wh-questions were asked and recognition was demanded when yes-no-questions requiring verification (v) of a proposition, were asked. In Table 1, the percentages of total questions asked representing each structure-content combination type are given. In parentheses, the percentage of total mothers' speech which consisted of the particular question type also appears. For both age groups, the ratio of wh- and verification questions changed with question content. For two-year-olds, verification questions in the event category were more frequently asked than wh-questions ($t(9) = 2.90, p < .05$). Thus mothers of two-year-olds were more likely to require recognition of event descriptions. For three-year-olds, however, the two proportions were about the same. For knowledge queries, however, more wh-questions occurred than verification at both ages ($t(9) = 5.21, p < .001$; $t(9) = 4.18, p < .01$) indicating that equivalent demands for recognition and recall of events

TABLE 1

PERCENTAGES OF THE TOTAL NUMBER OF QUESTIONS ASKED
BY MOTHERS THAT WERE THE FOUR QUESTION TYPES

Age	Event		Knowledge	
	Wh ^a	V	Wh	V
2	24.5 (5.4)	37.0 (8.7)	26.2 (6.4)	12.3 (3.0)
3	31.1 (6.0)	38.5 (8.2)	20.1 (4.4)	10.3 (2.4)

^aNumbers in parentheses indicate the percentages of total mothers' speech that were the four question types.

occurred. Parallel results were obtained when questions were considered as a proportion of total speech.

The change in question format as a function of question content was not expected and the reason for its occurrence is not immediately clear; however, other findings described later suggest possible explanations for this pattern of results. What is clear, however, is that mothers did not uniformly require more of older than younger children in terms of demanding greater recall or recognition of information. In fact the percentage of knowledge questions requiring recall significantly dropped with age. The nature of the information which the mothers wanted the child to remember, then, played an important role in whether recall or recognition was demanded and in what way these demands changed with the child's age.

Even though there were differing propensities to ask certain question types in response to the age of the child, mothers who frequently asked one type of question were likely to ask other question types. Mothers who were likely to ask many event questions also asked many knowledge questions and conversely, mothers who asked few questions of one type asked few of the other type at two years, $r = .76$, $p < .01$, and three years, $r = .53$, $p < .05$, of age respectively. Asking these questions did not seem to depend upon the language productivity of the child at either age. Correlations between

the mean length utterance score; a frequently used index of language ability (Brown, 1973), and percentage of mothers' speech which consisted of event and knowledge questions did not approach significance.

While asking questions of both types was related in general, differences emerged when questions representing the four structure-content combinations were examined. These relationships are provided in Table 2. For both age groups asking wh-event questions was not significantly related to asking any of the three other types, which were correlated among themselves. Event questions taking a wh-form seem to be of a special nature which will again be explored later.

Correct responses to event and knowledge questions. Thus far, we have been concerned with the types of questions mothers asked their children, but a related question of considerable interest is how well the child was able to respond to the memory demands of the mother and whether the ability to retrieve specific pieces of information changes with age. In Table 3 the percentage of questions asked of a particular type which were responded to correctly by the child are given. When the child did not answer questions correctly, he almost always failed to respond. Rarely was an answer given which was incorrect. No distinction, then, was made between an incorrect answer and failure to respond.

TABLE 2

CORRELATIONS AMONG THE PROPORTIONS OF MOTHERS' SPEECH
CONSISTING OF QUESTIONS OF THE FOUR GENERAL TYPES

	Age	V-event	Wh-knowledge	V-knowledge
Wh-event	two	.23	.43	.40
	three	-.28	-.14	-.29
V-event	two		.59*	.88***
	three		.53+	.68*
	two			.75**
Wh-knowledge	three			.73**

$p < .10+$

$p < .05^*$

$p < .01^{**}$

$p < .001^{***}$

TABLE 3

PERCENTAGES OF HOME QUESTIONS
ANSWERED CORRECTLY BY THE CHILD

Age	<u>Event</u>		<u>Knowledge</u>	
	Wh	V	Wh	V
Two	39.2	52.0	36.7	56.9
Three	52.0	58.0	45.6	56.9

For two-year-olds, verification questions were answered correctly more often than wh-questions in both the event ($t(9) = 2.26, p < .05$) and knowledge categories ($t(9) = 5.28, p < .001$); while three-year-olds were able to answer as many wh- as verification questions correctly in the event category. Nevertheless, the older children were still more successful in answering verification questions correctly in the knowledge category than wh-questions. Three-year-olds also answered a higher proportion of wh-event questions correctly than two-year-olds ($F(1,19) = 3.77, p < .10$), while correct responding did not differ between ages for the other three types of questions. For two-year-olds, then, correct recognition was higher than correct recall for both the event and knowledge information. For the older children the level of recall was comparable to that of recognition, at least for information about events. Apparently the retrieval of specific pieces of both event and knowledge information was difficult for the two-year-olds. For three-year-olds, recall equaled recognition abilities when information about the child's actions and direct experiences was sought (event); however, the level of recall was still lower than that of recognition if the information sought was more abstract knowledge and less a part of the child's activities (knowledge). This suggests that children first gain greater control of recall processes when the information retrieved concerns

events which are action-oriented and contextually based.

The validity of comparing the levels of correct responding to wh- and verification questions to infer relative ease of retrieval may be questionable since the level of chance responding may differ for the two types of questions. Correct responses to verification questions may have been a more likely random event because the child needed only to respond yes or no. Because children rarely provided incorrect answers to questions, however, it was assumed that children responded to both types of questions when they indeed knew the answers and thus the levels of chance responding were comparable for the two question forms.

Although correct responding increased with age at least for wh-event questions, even older children were not very successful in providing correct responses to these questions. Only approximately one-third to one-half of these questions were answered correctly by children of both ages which indicated that retrieving specific pieces of information at will was a very difficult task even in situations quite familiar. Thus, the major change in meeting these memory demands was an increasing ability to retrieve and produce specific pieces of information. These results correspond to other findings from memory tasks conducted in the laboratory that a major change in memory development involves an increase in recall abilities (e.g., Myers and Perlmutter,

1978).

It is interesting that the differences in memory and memory demands that have occurred between the two age groups have involved event questions. Three-year-olds were asked more event questions than two-year olds; three-year olds were asked as many wh- as verification-event questions, while two-year olds were asked more verification than wh-event questions; and three-year-olds were able to answer more wh-event questions correctly than two-year olds. Furthermore, at both ages asking wh-event questions was not correlated with asking any other type of question. These findings suggested that there was something unique about event questions, especially those demanding recall. This uniqueness was further demonstrated by the correlations provided in Table 4. Correlations among percentage correct responding to the four question types were carried out. In addition, correlations between these four percentages and MLU also are listed. The correlations among correct responses to the four question types given in parentheses are those obtained by partialling out the effects of MLU.

For two-year-olds, answering wh-questions in both categories correctly was related and language ability was associated with answering wh-knowledge questions correctly. When language ability was statistically controlled, however, the correlation between answering both wh-question types

TABLE 4

CORRELATIONS AMONG PERCENTAGE CORRECT RESPONSES
TO THE FOUR QUESTION TYPES AND MEAN LENGTH UTTERANCE

	V-	Wh-	V-	MLU
Wh-event	Event	Knowledge	Knowledge	
Two	.02 (-.04) ^a	.55* (.37)	.08 (-.11)	.46
Three	.68* (.56+)	.46 (.29)	.63* (.65*)	-.42
V-event				
Two		.10 (.02)	.41 (.40)	.12
Three		.56* (.34)	.25 (.23)	-.58*
Wh-knowledge				
Two			.49 (.35)	.66*
Three			.25 (.24)	-.59*
V-knowledge				
Two				.38
Three				-.10

^aCorrelations in parentheses are with MLU partialled out.

correctly disappeared. This suggests that at age two facility with language is an important part of the recall process, perhaps because the child needs an efficient verbal code to store or produce this type of information or both. Perhaps as well, the use of language depends upon the ability to recall the words needed to speak. Correct responding to y-questions, however, was not correlated with MLU. Recognition apparently does not require a great amount of verbal facility since the child is merely required to answer yes or no. Because there were no correlations between answering the two types of verification questions correctly it is possible that factors other than memory contribute to "correct" recognition. That is, the likelihood of the child answering a y-question may be due to random responses, prompting from the mother, or motivation.

For three-year-olds the pattern of responding was quite different. Answering both types of event questions correctly was positively related; answering verification knowledge questions correctly was positively related to correct responses to wh-event questions; and finally correct responses to verification event questions and wh-knowledge questions was positively related. Language ability, however, was negatively related to a high proportion of correct answers to wh-knowledge and verification-event questions. Furthermore, when the correlations with language

ability were partialled out, the positive correlation between answering verification event and wh-knowledge questions was no longer significant.

The above findings in combination seem to support the idea that asking wh-event questions consisted of making high level memory demands and that answering such questions correctly was a cognitive achievement of older, more competent children. We have seen that the major increases in memory demands occurred in the event category and that older children were better able to answer wh-event questions correctly. Conversely, I would like to argue that asking wh-knowledge questions seemed to represent a memory demand made of less able children, at least among the older children. Significant decreases with age occurred in asking wh-knowledge questions and answering these questions correctly was associated with lower levels of language productivity in older children. Furthermore, answering wh-knowledge questions correctly was positively related to answering verification event questions correctly, which was also negatively related to language ability. Although the reason for the negative correlation between language ability and correct answers to wh-knowledge questions is not immediately clear, correct responses to these questions do seem to reflect the abilities of less advanced children. For two-year olds, however, answering wh-knowledge and event questions was positively re-

lated to language ability which suggests that this type of memory demand was a more appropriate one for the younger children.

This picture is somewhat inconsistent, however, since at age three there is a negative correlation between MLU and percentage correct responding to the wh-event questions as well, although it is not significant. Furthermore, if asking a wh-knowledge question represents a lower level memory demand, older children should have been better able to answer the question than younger children. Perhaps, however, external contextual cues in the child's environment are important in helping the child retrieve information (e.g., . Myers and Perlmutter, 1975). Contextual cues which would be helpful in retrieving knowledge information may not be usually present in the child's external environment. On the other hand, children may simply not be motivated to ask knowledge questions which are asked many times by mothers, perhaps in response to the child's tendency not to answer.

Event Questions

Proportions of event questions asked. Each major question category was divided into question subtypes and a closer examination of these divisions provides more specific information about the nature of memory demands and responses to

those demands. These subcategories have been described previously; however, a brief summary will be provided here. The event category was broken down into 14 subcategories: ongoing activity (ONGO); events in the immediate future (FUT IMM); events in the immediate past (PAST IMM); future events (FUT); events occurring within the current observation session (WITHIN SESS); events occurring during the total observation period (TOTAL SESS); events occurring before the observations began (BEF SESS); events occurring at some unknown time in the remote past (OTHER REM PAST); events that occur habitually (HABIT); fictional events placed in a past context (FIC PAST); the reason for an event's occurrence (REASON); conditional events (CONDITIONAL); other events (OTHER); asking for clarification of the child's most recent statements (CLAR). In Table 5, percentages indicating the proportions of total wh-or y-questions asked that were of a particular type are listed. Overall few changes occurred from age two to three in the types of questions mothers asked their children. There were however significant increases in asking these types of questions: wh-questions dealing with conditional events ($F(1,19) = 4.01, p < .07$) and questions asking the child to clarify his most recent utterances under conditions of both recall ($F(1,19) = 3.42, p < .10$) and recognition ($F(1,19) = 4.10, p < .10$). Reflecting upon the occurrence of

TABLE 5

PERCENTAGES OF EVENT QUESTIONS ASKED OF EACH TYPE

	Ongo		Fut Imm		Past Imm		Fut		Within Sess	
	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V
Two	22.6	25.7	2.2	6.7	4.7	7.4	5.8	6.9	2.9	3.8
Three	24.7	18.9	4.1	5.6	3.2	6.5	4.1	3.9	3.8	5.4

	Total Sess		Before Sess		Other Remote Past		Habit		Fic Past	
	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V
Two	4.0	3.0	3.4	10.3	2.8	3.4	5.8	4.8	1.0	1.2
Three	5.0	4.5	5.3	7.2	1.0	2.9	5.1	5.0	1.0	.4

	Reason		Condition		Clarification		Other	
	Wh	V	Wh	V	Wh	V	Wh	V
Two	19.2	1.8	.1	.4	23.8	23.8	2.1	1.0
Three	7.6	1.3	1.0	.3	33.1	36.5	1.0	2.0

events under certain conditions would seem to be a capability acquired with age and thus a more likely source of questioning for older children. Nevertheless, very few questions of this type were actually asked rendering interpretation suggestive at best. It is somewhat surprising, however, that mothers would more often ask older than younger children to clarify or repeat what they had just said. As would be expected MLU increased significantly from ages two to three (2.64 vs 3.9). Thus, older children who were combining more words together than younger children may have done so in a way which was more often confusing to their mothers and which often required restatement. Perhaps as well, mothers of older children may have been less willing to accept poorly formed sentences and asked more clarification questions to induce the child to re-phrase his sentence in a syntactically better way. The overall increase in event questions noted earlier was apparently largely due to questions dealing with language events occurring in the immediate past (clarification).

Both older and younger children were asked a relatively large number of questions concerned with activities performed at the present moment or occurring in the immediate past or future. Many fewer questions were concerned with events removed from the present context in time or space and these questions did not increase with the age of

the child. At both two and three years of age, respectively, there were significantly more Ongo questions than Within session ($\underline{t}(9) = 3.17, p < .01$; $\underline{t}(9) = 2.22, p < .05$), Total Session ($\underline{t}(9) = 3.17, p < .01$; $\underline{t}(9) = 2.28, p < .03$), Before Session ($\underline{t}(9) = 2.47, p < .05$; $\underline{t}(9) = 2.09, p < .06$), or Other Remote Past Questions ($\underline{t}(9) = 2.47, p < .05$; $\underline{t}(9) = 6.55, p < .001$). Mothers of these young children dealt very much with the here and now (ongo questions) and past events (within, total, and before session and other remote past questions) did not dominate questions asked in conversations with their children. Nevertheless, it is significant that past events did comprise a fairly frequent source of information queried requiring young children to periodically think about and possibly remember past occurrences in their lives.

Mothers were fairly consistent in their tendencies to ask about events in the past or present. In Table 6, correlations are provided between the percentages of questions asked of particular types. Of interest here is the relationship between asking questions about the present (ongo; future and past immediate), past (within, total and before session; other remote past, habit) and future for each age group. It was expected that mothers would consistently ask questions dealing with present events so that

positive correlations were expected among present-event questions shown in Table 6. It was also expected that mothers who consistently asked questions about present events might avoid asking questions about both past and future events. Thus negative correlations were expected between present-event questions and past-event questions shown in Table 6.

Mothers of the younger children who were likely to question them about the present using one type of question (ongo; past and future immediate) were likely to do so using the other two types of present-event questions as well. Positive correlations occurred between the two types of ongoing questions (wh- and v-), between ongoing and future immediate questions, and between future and past immediate questions. If the frequency of asking each question type was divided by the total number of utterances of the mother instead of the total event questions asked and these proportions were correlated, a very similar pattern of results was obtained; however, the relationship between the questions dealing with present context events were even stronger. Wh-Ongoing questions were positively correlated with v-Past Immediate ($r = .86, p < .001$) and Future Immediate ($r = .60, p < .05$); v-Ongoing questions were correlated with v-Past-Immediate ($r = .84, p < .001$) and Future Immediate

questions ($\underline{r} = .92$, $\underline{p} < .001$); and \underline{v} -Past Immediate questions were correlated with \underline{v} -Future Immediate ($\underline{r} = .86$, $\underline{p} < .001$). Mothers of two-year-olds who asked questions about the very recent past (past immediate) were also highly likely to ask similar question about past events which occurred slightly earlier with the observation session (within session).

For three-year-olds there was much less consistency among the questions dealing with present situations, although some positive correlations did occur between \underline{v} -ongo, past immediate, and future immediate questions. Again if the proportion of event questions which were of each category type were correlated, these further correlations were obtained: \underline{v} -Ongo and \underline{wh} -Past Immediate ($\underline{r} = .76$, $\underline{p} < .01$), \underline{v} -Past Immediate ($\underline{r} = .67$, $\underline{p} < .05$), and \underline{wh} -Future Immediate ($\underline{r} = .69$, $\underline{p} < .05$); and \underline{v} -Future Immediate with \underline{wh} -Past Immediate ($\underline{r} = .70$, $\underline{p} < .01$) and \underline{v} -Past Immediate ($\underline{r} = .69$, $\underline{p} < .05$). In general then, mothers were fairly consistent in asking questions about present events (ongo, past and future immediate), although this pattern was not a strong one.

When the correlations between the group of questions dealing with present events (ongo; past and future immediate) and past events (within, total, and before session, other remote past, and habit) are inspected in Table 6,

predominantly negative correlations emerge as significant. At age two, negative correlations resulted between wh- and v-ongo questions and total session, wh-before session, wh-other remote past, and wh-future. Past immediate questions were positively correlated with within session questions, however. At age three, negative correlations occurred between v-ongo and total session, before session, and habit questions. Past immediate questions were negatively correlated with within session questions. No correlations were significant between the group of present event and future questions. At both ages, then, there was a tendency for mothers who asked many questions about the present to ask fewer questions about the past, since negative correlations for the large part occurred between the present and past event questions. Even though all mothers tended to talk about present events with their children, since a large proportion of all event questions were ongoing questions, some mothers were consistently more likely than others to introduce discussions of the past into their dialogues.

In Table 7 correlations among the proportion of questions asked dealing with the past (within, total, and before session; other remote past, habit), recent language events (clarification), and other events (future, reason, conditional) are shown. Positive correlations were expected among past-event questions, but predictions were not

TABLE 7
SIGNIFICANT CORRELATIONS AMONG PROPORTION OF TOTAL MOTHERS' SPEECH
REPRESENTING VARIOUS EVENT CATEGORIES

	Within Sess	Total Sess		Bef Sess		Other Rem Past		Habil		Ful		Reason		Cond		Clar	
		Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V
Within Sess	Wh																
	V																
Total Sess	Wh																
	V																
Bef Sess	Wh																
	V																
Other Rem Past	Wh																
	V																
Habit	Wh																
	V																
Clar	Wh																
	V																

TWO-YEAR OLDS

made concerning other correlations. At both ages there were numerous positive correlations among asking total and before session questions, and other remote past. Thus, mothers who asked questions about events that occurred in one past time period asked questions about past events in the other time period (before all observations began and the time during the total observation sessions). At age three, mothers who questioned their children about events occurring within the observation session (within session) tended not to ask questions about earlier time periods (total and before session, other remote past) since negative correlations were observed between the two sets of questions. At age two, no correlations were observed between the within session and more distant past questions (total and before session, other remote past).

The relationship between asking questions about past and future events was less clear, however. At age two there tended to be a positive relationship between these two types of questions so that mothers asking many of one type asked many of the other. At age three, there were either no associations between the two or conflicting relationships. Specifically, asking verification-remote past questions correlated positively with asking future questions, while asking questions concerned with events prior to the beginning of the observation sessions (before

sess) correlated negatively with asking questions about the future. Mothers of younger children who questioned frequently about events not occurring in the present context, tended to do so in an undifferentiated way asking both questions about the past and future. If mothers of older children adopted a questioning style about the past, future events were not discussed in a consistent way.

Overall, these patterns of correlations indicated that mothers were fairly consistent in either discussing events occurring in the immediate present or broadening their discussions to include inquiries about events removed from what was happening at the present time. In general, adopting one style or the other did not seem to largely depend upon the language ability of the child, since MLU was correlated positively only with asking wh- Before Session questions of two-year-olds ($r = .78$, $p < .01$) and with asking wh- and y- Total Session questions of three-year-olds ($r = .72$, $p < .01$; $r = .70$, $p < .05$). Thus, what the child was capable of talking about may have influenced the focus of the mother-child dialogues to some degree but did not appear to be the primary factor in mother's choice of the events talked about.

Percentage of correct responding to event questions. Dividing the event question category into various question types, permits a more precise examination of what types of information children were most capable of providing. As noted earlier, there was an overall increase with age in correct responding to event questions demanding recall but not recognition. In Table 8 the proportion of total wh- or y-questions asked that were correctly answered are listed for each event category. Under each entry in parentheses is the number of children who were asked a particular question type, since not all children were asked all question types. For wh-questions there were several types of questions which three-year-olds were more successful in answering than two-year-olds. These included Future ($F(1,19) = 4.42, p < .05$); Total Session ($F(1,19) = 5.50, p < .05$); Reason ($F(1,19) = 2.99, p < .10$); Habitual ($F(1,19) = 5.05, p < .05$); and Clarification questions ($F(1,19) = 5.55, p < .05$).

Both two- and three-year-olds had difficulty retrieving information about events occurring before the observation sessions (before session), but when the events occurred within a one-to-two-week-period of the question (total session questions), three-year-olds were much more capable of successfully retrieving the information. Clearly children at both ages were capable of spontaneously remem-

TABLE 8

PERCENTAGES OF EVENT QUESTIONS ASKED THAT
CHILDREN ANSWERED CORRECTLY

	Ongo		Fut Imm		Past Imm		Fut		Within Sess	
	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V
Two	42.1	51.0	29.7	64.7	23.5	51.9	35.3	64.3	34.6	33.3
Three	43.6	55.8	58.8	44.8	20.0	56.5	69.4	53.5	35.8	44.2

	Before Sess		Total Sess		Other Remote Past		Habit		Fic Past	
	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V
Two	30.0	40.7	24.2	40.9	49.5	49.0	28.8	36.4	20.0(3) ^a	26.2(3)
Three	25.4	49.2	65.1	61.5	44.0	62.6	63.2	36.8	29.2(4)	60.0(3)

	Reason		Conditional		Clarification		Other	
	Wh	V	Wh	V	Wh	V	Wh	V
Two	20.5	39.6	0.0(1)	66.7(3)	56.8	58.4	20.0	41.7
Three	35.9	49.4	50.0(4)	40.0(1)	73.5	60.8	30.0	61.8

^aNumbers of children asked a particular type of question are given when the number is less than five.

bering information about events which occurred beyond this time period; however, the time period during which the particular event occurred influenced how well the information could be retrieved when asked for. This would suggest that decay of the memory trace over time played an important role in the retrieval of remembered information for these children. For younger children, remembered information might be lost relatively faster or not be as easily accessible in some way. Thus, it would be expected that few differences would be found between the age groups for events which occurred farthest away in time from the moment the memory question was asked. Similarly, events happening very close in time to the moment the memory question was asked would be accessible to children at both ages. Differences would be expected for events in some time period between the two extremes. One factor which could modify the effects of long time lapses between the event and the memory question might be the repeated occurrence of events. If an event occurs frequently enough providing a kind of rehearsal, older children might overcome their usual difficulties in retrieving information about events occurring in the distant past.

Older children were also better at remembering information about events which had occurred frequently in the past (habit), events yet to come (future), and what

they had just said (clarification). In general, across the various event categories no changes occurred in recognizing information. The only significant change observed was actually a decrease with age in correctly responding to questions concerned with events in the immediate future ($F(1,19) = 4.71, p < .05$). The interpretation of this finding is unclear.

While there were several important types of information older children were better able to recall when asked than younger children, only the proportion of questions asked by mothers which were clarification questions increased with age. There was no evidence then, that the improved recall of the older children was linked to an increase in asking questions with the increase in age of the child. Thus, improved memory ability with age did not seem to occur as a function of increasing memory demands. The use of a cross-sectional design, however, may have obscured observing such increases over time. In order to provide a more precise test of the relationship between increasing demands and increasing memory ability, it would be necessary to conduct a longitudinal study.

Correlations among correct responses. In order to examine if the ability to correctly remember information asked for was consistent across all types of information, the proportions of correct responses to the various types of event-

questions were correlated. Only children who were actually asked the questions representing each category were included in the analyses. For some correlations, then, the numbers of children included were quite small and care should be taken in assessing the significance of these correlations. Categories in which less than five children were asked the question type were fictional past, conditional and other questions. This was true at each of the two ages.

Intercorrelations were calculated among percentage correct responding to the wh-questions and between the wh- and verification questions answered correctly within the event categories. In addition, correlations were computed between correct responses to the types of wh-event questions and MLU. These correlations appear for two-year-olds in Table 9 and for three-year-olds in Table 10.

At age two, there were positive correlations between correctly answering a high proportion of questions concerning ongoing activities (ongo) and events taking place within the observation session (within session). There were also positive correlations between answering future and past immediate questions correctly. Negative correlations occurred between providing correct answers to fictional past questions and past immediate, future immediate, and within session questions. Answering future questions correctly was positively correlated with answering total session,

reason, clarification, and before session questions correctly. Answering before session questions correctly was positively correlated with total session, reason, and habit correct responses. It was expected that positive correlations would occur among correct answers to present event questions and among past event questions. There were a few correlations that fit that pattern, but overall there was not a great deal of consistency. In general no correlations emerged among answering present-event questions correctly (ongo ; past and future immediate) and past event questions correctly (within, total, and before session; other remote past and habit). Apparently children who answered one type of question correctly did not consistently answer the other type.

For three-year-olds, answering a high proportion of ongoing questions correctly correlated positively with answering many clarification questions correctly and negatively with answering many future questions correctly. Not as much consistency was observed for the older children in their answers to these questions. A major change between the two ages was the relationship between correctly answering questions about the future and the past. For two-year-olds these abilities were positively correlated, however, for the older children negative relationships occurred. Mothers of two-year-olds who asked many questions

of one type tended to ask many of the other which may have provided experience for these children in answering the past and future questions. For three-year-olds, mothers' asking of past and future questions was not correlated which might have contributed in some way to the negative correlations between children's answering past and future questions correctly.

At both ages, correctly answering questions about past events occurring during the total observation period was positively correlated with answering questions concerning habitual events and events occurring at some point in the remote past. No correlations were observed between total and before session questions. The correlation between total session and other remote past questions was not too surprising, since past events referred to in the questions by definition would have occurred before the observation session in which the question was asked. The exact time of the event in question was not known so that the question could not be assigned to the before or total session category. Therefore, it was highly likely that at least some of the remote past events actually occurred within the total observation period. It is interesting that correct responding to total session and habit questions was positively correlated. Correct responding to these question types also increased with age indicating

that memory improves between these ages for events within a specific time period or given that events occur before that time period, repeated occurrences of the event strengthens the memory trace or makes it more accessible in some other way. That these two conditions have comparable effects is reflected in the ability to correctly respond to questions concerned with both types of events.

In general, few correlations were observed between correct answers to wh- and y- questions within the same event category. At age two, only three of the 14 correlations were significant. Correct answers given to wh- and y- conditional questions were negatively related. At age three, seven of the 14 correlations were significant. Positive correlations between correct answers to wh- and y- questions in the Ongo, Reason, Habit, Clarification and Before Session were observed, while negative correlations occurred between correct answers to future and future immediate questions. For the older children then, there appeared to be a somewhat stronger relationship between correct responding to both the wh- and y- forms of question type than for younger children; however, this relationship did not occur across all categories nor in the same direction. Undoubtedly many children who answered y- questions correctly did not also answer the wh- form of these questions correctly. This suggests that recall and recognition abilities

differ.

Correlations among correct responses to verification event questions were calculated analogously to the correct responses to wh-questions shown in Tables 9 and 10. Few significant correlations were obtained, however, and no discernable pattern emerged among answering present (ongo, past and future immediate), future, and past (within, total, and before session, habit, and conditional) questions correctly at either age. Therefore, these data are not presented. One interesting set of correlations did occur, however, for the three-year-olds. Correctly answering many questions about ongoing events and restating what had just been said (clarification questions) was highly, positively correlated ($\underline{r} = .84, p < .001$) and correct responses to both ongoing and clarification questions were negatively correlated with MLU, respectively ($\underline{r} = -.80, p < .01$; $\underline{r} = -.46, p < .10$). Thus, the older children who correctly answered questions about the present (ongo) and recent language events (clarification) did so consistently, but had lower levels of language ability.

Overall, the data concerning children's correct answers to event questions indicate that there was fair consistency in the ability to recall various types of information; however, correct recognition did not occur consistently across categories nor was this ability strongly related

to recalling similar types of information. These findings undoubtedly were influenced by the consistency and frequency of the mothers' asking of the questions so that again care should be taken in interpreting the results.

Interpretation of correlations among correct responses to overall event and knowledge questions and language ability.

The correlations among correct responses to the various categories of event questions also provide information concerning the correlations between correct responses observed for the three-year-olds and listed in Table 4. These correlations can best be understood in terms of relationships among question subtypes and language ability. The positive correlation observed between percentage of correct responses given to wh-event and v-event questions appears to be largely due to the correct responses given to ongo and clarification questions. Correct responses to the wh- and v- forms of both questions types was positively correlated; and because correct answers given to these questions represented 73% of all correct answers given to wh-questions and 56% of all correct answers given to v-questions, the correlations emerged for the category as a whole. Furthermore, the negative correlation between percentage correct for v-event questions in general and MLU, appeared to be largely due to negative correlations obtained between MLU and the percent of clarification and ongo questions answered correctly,

just discussed in the previous section.

It may seem contradictory that a high percentage of correct answers to any question would be negatively related to some other ability. Such a relationship could occur for at least three reasons, however. First, if mothers asked many questions of one particular type, which were relatively easy to answer, children might be likely to answer many or most of them and a high percentage correct score would result. Such a question type could be ongoing questions which deal with present events. Answering these questions would require relatively little memory processing. If frequently asking this question type were negatively related to language ability, then a high percentage correct score would be related to low language ability as well. Thus, a negative correlation between language ability and percent correct responding might reflect the fact that this easy type of question was asked frequently, not necessarily that the question type was answered correctly a large percentage of the time. There was a trend toward a negative correlation between MLU and the percentage of questions asked that concerned ongoing events; however, in general, correlations between asking various question types and MLU were nonexistent or positive. Thus, this explanation does not account for the negative correlations between MLU and percent correct responding to the event questions.

A second possibility would be that if mothers asked very few questions of a particular type which could be answered successfully by the child, a high percentage correct score would result. If asking this hypothetical type of question infrequently was negatively correlated with language ability, then a high percentage correct score would be related to low language abilities as well. Thus, negative correlations would reflect that few questions of a particular type were asked. This does not appear to be the case for y-event questions, though, since no significant correlations occurred between percentage of questions asked in the overall event category or in the ongo and clarification subcategories and MLU. This does appear, however, to explain the negative correlation observed between MLU and answering wh-knowledge questions correctly. There was a positive correlation between proportion of questions asked of this type and MLU. Thus, children who were asked very few knowledge questions apparently had lower levels of language productivity and we could infer that these few questions could nevertheless be answered successfully.

A third possibility is that children who answer a large proportion of questions of a particular type correctly can answer only those questions correctly. Thus, a high proportion of their correct answers to all questions across categories would be in response to only one or two question

types. If this were true, a positive correlation would be expected between the proportion of particular questions answered correctly and the proportion of correct answers given to all questions across categories which are in response to that particular question type or types. For example, suppose that a mother's event questions were largely of the ongo type. Suppose also that her child answered a high proportion of these ongo questions correctly. Suppose further that the child is able to answer only the ongo questions correctly. Thus, a large proportion of correct answers given to all event questions across all categories would be largely in response to the ongo questions.

The percentage of all correct answers given to all event questions which were in response to the ongo questions (or any other event question sub-type) could be calculated. A high percentage score would result for correct answers given to ongo questions, if the correct answers given to all event questions came in response to the ongo questions. If children who answered a high percentage of ongo questions also answered only the ongo questions correctly out of all event questions asked, then a positive correlation would occur between the two percentage scores. Indeed, there were significant, positive correlations between the proportion of y-ongo and y-clarification questions answered correctly and the proportion of correct

answers given to all v-event questions which were in response to v-ongo and v-clarification questions. Thus, children who answered the largest proportion of these questions correctly also largely produced correct answers in response to only these questions. It is not too surprising that children who could only provide correct answers to questions concerning present events and recent past language events would have lower levels of language ability. Furthermore, because correct answers given to these two types of questions comprised the major proportion of correct answers given for all children, the overall negative correlation between MLU and answering v-event questions correctly resulted.

Now let us turn to the correlations between answering the event and knowledge questions correctly. There are two positive correlations: between wh-event and v-knowledge and between v-event and wh-knowledge. Even though the sub-categories of the knowledge question category have not yet been described, we can foreshadow that discussion a bit and say that the most frequent types of questions asked dealt with object and person name, object properties, and object locations. The correlations between correct responding to the wh-event and v-knowledge questions appeared to occur for two reasons. The first is that there were positive correlations between answering

wh-ongo questions correctly and answering v-object location questions correctly. Because these questions comprised a large percentage of the questions asked in each of the two categories, the correlations for the category as a whole occurred. There is also the suggestion that answering these two types of questions correctly reflects a less competent child since answering a high proportion of ongoing questions was not an advanced ability. There were other correlations, however, between categories which appeared to reflect the abilities of more competent children as well. These were positive correlations between answering v-object name questions and wh-total session ($r = .68, p < .05$) and wh-before session questions ($r = .79, p < .01$). Finally, the correlations between the v-event and wh-knowledge questions occurred because of the relationship of each with language ability already described. When this relationship with MLU was statistically controlled the significant correlation between the two types of questions disappears.

Knowledge Questions

As with the event question category, knowledge questions were divided into many subtypes to more precisely characterize the kinds of information mothers asked their young children to remember. These subdivisions consisted

of the following: object name; person name; actions or functions of objects or people (ACTIONS); object location; object properties; information concerning the age of objects or people (AGE); the superordinate or subordinate class of a particular object or person (CATEGORY MEMBERSHIP); social routines; identifying the number of objects contained in a particular set (OBJECT-COUNT); comparing two objects on one or several dimensions (OBJECT-COMPARISON); fantasizing that an object was something other than it actually was (OBJECT-PRETENDING); personalized information about objects; inferences; information concerning game or play activities (GAMES); letter or number knowledge (SYMBOL); counting (COUNT ROUTINE); repetition of visual or auditory materials (VIS/AUD); non-verbal actions; Other; any information pertaining to objects placed in a past (PAST) or future (FUTURE) context.

Question Proportions. In Table 11, percentages indicating the proportions of total wh- or v- questions asked of particular types are listed. As found with event questions, few changes occurred from age two to three in the types of knowledge questions mothers asked their children. At both ages the categories representing the largest proportions of questions asked included those concerning object and person names, object location, and object properties.

TABLE 11

PERCENTAGES OF TOTAL WH AND VERIFICATION KNOWLEDGE QUESTIONS
OF EACH TYPE

	Object Name		Person Name		Actions		Location		Object Properties		Age	
	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V
Two	24.7	10.7	11.1	8.4	1.9	1.5	22.7	15.3	18.2	33.6	1.3	.2
Three	15.8	6.3	7.0	4.3	1.3	1.7	21.7	13.1	14.2	28.4	1.4	4.0

	Category Membership		Social Routine		Object-Count		Object-Comparison		Object-Pretending		Personalized Object Knowledge	
	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V
Two	.5	.3	3.2	.4	2.9	2.0	.3	3.3	0.0	1.4	1.6	6.9
Three	.5	0.0	4.3	3.6	5.4	.2	1.1	4.1	1.0	1.1	5.2	9.4

	Inferences		Games		Symbol		Counting Routine		Vis/Aud		N-V Actions		Other	
	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V
Two	.3	.4	5.9	7.5	1.6	1.1	1.5	.1	2.5	1.7	1.5	.2	1.7	3.1
Three	.9	.6	2.4	6.8	8.4	.8	1.0	.1	4.1	5.3	2.3	.2	3.4	5.8

There was wide variety in the remaining questions with few questions of each type asked. Apparently mothers differed in the types of knowledge they expected their children to know and overall these expectations did not consistently change with the age of the child. Age differences were observed for only two types of questions: a marginally significant decrease in asking for recall of the names for objects ($F(1,19) = 3.5, p < .10$); and a significant increase in asking for recall of personalized information about objects ($F(1,19) = 6.11, p < .05$). The proportion of questions that dealt with objects in a past or future context do not appear in Table 11 because the questions were collapsed over question type (wh and y), since there appeared to be very few. The proportions of total knowledge questions asked (wh and verification combined) that were concerned with objects in a past context were 3.8% and 4.8% for two- and three-year-olds respectively, and questions about objects in a future context comprised 2.3 and 3.4 percent of all knowledge questions asked at two and three years of age. No significant age differences occurred.

From the MLU index reported earlier, younger children's language abilities were less well developed than those of older children and thus they were likely to still be learning the names for basic objects. Perhaps mothers of younger children asked more questions about object names

to aid the process of vocabulary acquisition. Mothers of older children, however, were more likely than mothers of younger children to ask about objects embedded in particular contexts (personalized object knowledge). Questioning the child about particular objects in a past context may be as demanding as questioning the child about events, in that creative use of retrieval skills will be needed to deal with the information.

Although there appeared to be differences among mothers in the types of information about which they questioned their children, there was fair consistency in the types of questions a particular mother asked. In Table 12, correlations appear among the proportions of mothers' speech involved in asking questions of the various types. Because there was inconsistency in the types of questions asked, many questions were asked of only a small number of children making the resulting correlations suggestive at best. Therefore, correlations were examined between a set of the most frequently asked questions and the remaining types. At both ages, mothers who frequently asked questions about the names of objects also asked questions concerning object locations and properties. At age two, however, few correlations occurred between the object and person name, object location, and object properties questions and other types. It is interesting to note, however,

TABLE 12
SIGNIFICANT CORRELATIONS AMONG PROPORTIONS OF MOTHERS' SPEECH REPRESENTING
KNOWLEDGE CATEGORY SUBDIVISIONS

Two-Year Olds	Object Name		Person Name		Actions		Locations		Proper Ties		Age		Cat. Mem		Soc Rout		Obj- Count
	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	
Object	Wh	.58*						.59*					.86*		.47+	.76*	
Name	V				.57*	.88**	.81*	.54*									
Person	Wh				.57*	.79*	.48+										.45*
Name	V					.66*	.51+	.72*	.76*								
Location	Wh						.92**	.66*									
	V												.61*		.51+		
Object	Wh								.82*								
Properties	V																
THREE-YEAR Olds																	
Object	Wh	.50+			.75*	.76*	.54*	.62*									
Name	V		.73*	.85**					.86**	.80*	.58*						
Person	Wh			.85**					.53*	.97**	.73*						
Name	V								.76*	.89**	.51+						
Location	Wh						.70*										
	V							.50+									
Object	Wh								.45+							.52*	.68*
Properties	V															.67*	.53*

$P < .10+$

$P < .05*$

$P < .01**$

TABLE 12 (Cont.)

TWO-YEAR CLDS		Obj- Comp	Obj- Pretend	Person- alized	Inf	Games	Symbol	Vis/Aud	Count Routine	N-V Actions	Fast	Fut
Object	Wh											
Name	V	.60*				-.47+		.53*				
Person	Wh	.45+		.57*				.78*	.46+			.69*
Name	V					-.52+	-.48+					
Location	Wh					-.55*		.48+				-.45+
	V		.48+			.48+						
Object	Wh											-.53*
Properties	V											
THREE-YEAR OLDS												
Object	Wh		.61*			.77*	.77*	.76*				.77*
Name	V	.78*	.83*	.86*	.89**	.77*	.87**	.89**	.51*	.64*	.72*	.95**
Person	Wh	.64*	.61*	.64*	.88**	.65*	.92**	.88**		.80*	.45*	.83*
Name	V	.79*	.80*	.64*	.85*	.63*	.94**	.91**	.68	.80*	.48*	.91*
Location	Wh					.56*	.62*				.69*	
	V										.46+	
Object	Wh								.68*	.68*		
Properties	V	.86**	.93**	.52+	.65*	.78*	.69*	.66*	.56*	.53*	.61*	

$p < .10+$
 $p < .05+$
 $p < .01**$

that asking questions about people's names was positively related to several of the more infrequently occurring and possibly more difficult types of questions (object-comparison, object-pretend, personalized, inferences, vis/aud, past, and future). This trend occurred even more so for mothers of three-year-olds. It was suggested earlier that knowledge questions may be a part of question-answer routines established between mother and child. Asking for the names of objects would seem to be a type of a question that would fit that pattern and indeed asking wh-object name questions was correlated with asking questions about object actions, locations, and properties which could also form routines. Names of persons, however, may be less likely to be involved in such routines. Many of the questions asked about people's names were not concerned with those names that would be familiar to the child, but usually were questions about the observer's name or someone who would come to visit. These questions, especially for older children, correlated more with questions about comparisons between objects, "fantasy" objects, inferences, and questions about objects in past contexts. These question types would less likely be a part of established routines and would be more similar to several types of event questions, in that the child would have to try to access information never retrieved before in order to understand or answer

the question. Thus these questions would appear to be more demanding and mothers seemed to either adopt a style of questioning about stable aspects of objects or questions about objects in changing contexts.

In addition to the correlations appearing in Table 12, correlations between wh and y questions within the same category were calculated. In contrast to event questions, there tended to be a large number of correlations between the two question forms within a particular category. For two-year-olds, 12 of the 18 correlations were positive and significant and for the three-year-olds 14 of the 18 correlations were positive and significant. (Only 18 correlations were calculated because at each age level no questions were asked of one particular type.) These correlations suggest that mothers were interested in questioning thier children about particular types of information and used both question forms consistently in attempting to obtain this information.

Proportion correct. In Table 13, the proportions of questions asked of each category type that were answered correctly are listed. If the number of children asked a particular question type was less than 5 at either age, the number of children on which the analysis was based appears in parentheses. A now familiar pattern of finding few age

TABLE 13

PERCENTAGES OF QUESTIONS IN EACH KNOWLEDGE CATEGORY
ANSWERED CORRECTLY

	Object Name		Person Name		Actions		Location		Object Properties		Age
	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	
Two	35	57	21	55	46	36	31	57	32	77	46(3) ^a 0.0(1)
Three	33	74	24	92	75	33	44	63	46	60	05(3) 1.0(4)

	Category Membership		Social Routine		Object-Count		Object-Comparison		Object-Pretending		Personalized Knowledge Of Objects	
	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V
Two	28(2)	1.0(2)	42	0.0(2)	24	19(4)	33(3)	38(7)	0.0(0)	71(4)	25	71
Three	25(4)	0.0(0)	51	58(6)	42	66(1)	46(3)	38(4)	75(5)	67(3)	46	65

	Inferences		Games		Symbol		Counting Routine		Vis/Aud		N-V Actions		Other
	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	
Two	50(3)	16(2)	58	87	50	50(4)	64	19	48	66(3)	48	1.0(1)	33 68
Three	33(2)	0.0(2)	33	86	61	33(3)	11	66(1)	54	57(5)	46	1.0(1)	23 59

^aNumbers of children asked a particular question type are given when the number is less than five.

differences in the dependent measures occurs here again. Older children were more likely to correctly provide answers to verification person-name questions ($F(1,19) = 5.49$, $p < .05$) than younger children and were less likely to correctly answer wh-counting routine questions ($F(1,19) = 6.10$, $p < .05$). For the past context questions, 36.8 and 51.3% were answered correctly at ages two and three respectively and for future context questions, 25% were answered correctly at both ages. These differences were not significant and no other age differences occurred. Again we also see that in general correct responding was at a fairly low level at both ages. Even very simple questions requiring the recall of the names of objects were only answered correctly one-third of the time. As with events, young children have great difficulty in retrieving specific pieces of information in response to questions requiring them to do so. Furthermore, it appeared that children were inconsistent in their abilities to correctly retrieve when they did so.

In Table 14, correlations among the proportions of questions answered correctly appears. Only questions asked of more than five children at each age level are included in this table. As can be seen, few correlations occurred among these proportions, indicating that the ability to retrieve one type of information did not predict the ability

to retrieve other types. This is interesting in light of the fact that mothers were fairly consistent in asking the various types of knowledge questions, much more so than in asking the event-questions. This consistency may provide further evidence that the knowledge questions indeed represented stable questioning routines. The asking of event-questions would have more likely occurred in response to what was happening and less consistency might be expected.

In general, then, neither the asking or correct answering of knowledge questions increased with the age of the child. In fact, there was an overall decrease in the asking of knowledge questions which appeared to be largely due to a decrease in asking questions about the names of objects. There were, however, increases with age in the asking of questions concerned with personalized knowledge of objects and in the answering of questions concerned with people's names. Furthermore, there appeared to be two styles of knowledge question asking: one in which stable properties of objects were emphasized and one in which the changing contexts of objects were emphasized. These styles appeared at both ages, but were more apparent among mothers of older children. These findings suggest that as children grow older, mothers may consistently deal more with contextual and episodic information about objects and people rather than focusing as heavily on invariant aspects

of objects and people.

Implications of Findings from Observational Data

A major question of interest was whether mothers require more memory processing of older than younger children. This could be accomplished by asking older children more questions overall, more questions requiring recall than those requiring recognition of information, and more questions of particular types. In general, striking age differences did not occur. Mothers of older children did not ask more questions overall and did not require more recall than recognition of information. Mothers did tend to ask older children more event than knowledge questions. Event questions in some respects were indeed thought to be more demanding. Event questions dealt with information which would be tagged in memory by time and context. Because the events asked about would likely vary in both time and context, creative use of retrieval skills might be needed in order to comprehend all event questions and possibly to answer them. Knowledge questions, which were asked more often of younger children, seemed likely to be parts of mother-child, question-answer routines. Thus, comprehending this type of request for information would be well-practiced, and creative use of retrieval skills would not be needed in dealing with the information. This suggests that retrieving knowledge of objects, symbols, and routines

would be easier than retrieving event information because it had been well-practiced. Correct responding to knowledge questions was not higher for older than younger children, however, and was not higher than correct responding to event questions. In fact, correct responding to wh-event questions increased with age and for three-year-olds did not differ from correct responding to y-event questions. Since event questions were as easy to answer as knowledge questions, it is difficult to make a case for the hypothesis that event questions require more retrieval skills to answer. Perhaps, external contextual cues present in the environment help the child to answer event questions but not knowledge questions. On the other hand, the child may simply not be motivated to answer knowledge questions which have been asked so many times before. These questions may be asked repeatedly because the child has not learned the information.

Changes with age in the types of event and knowledge questions asked occurred fairly infrequently. All mothers centered their conversations very much in the immediate present, although some mothers consistently broadened their conversations to include discussion of past events removed from the present. Mothers who asked many event questions also asked many knowledge questions. Among mothers a wide variety of knowledge questions were asked but individual mothers were consistent in asking similar types of questions.

In general children's correct responding to questions was at a fairly low level. Retrieval of information appeared to be extremely difficult for these young children. Children's ability to answer questions correctly increased overall only for wh-event questions which was found to be largely due to increased correct responding to total session and clarification questions. Consistencies in correct responding to questions occurred between the event and knowledge categories as a whole, but there was not a great deal of consistency in answering questions correctly within each category, across the various information subtypes, for either event or knowledge questions.

In the following sections, the laboratory measures are presented and the asking and correct answering of event and knowledge questions are related to production and verification performance.

Verification and Production Measures

Overall performance on memory tasks. The verification and production dependent measures are listed in Table 15. A preliminary analysis of variance was conducted to determine if sex, order, the interaction between the two, or any interactions between these and age occurred. No main effects or interactions were determined.

In the verification task, the total number of correct responses did increase slightly though significantly with

TABLE 15
VERIFICATION AND PRODUCTION PERFORMANCE

	Verification ^a						Number of Discrepancies Between Verbal and Nonverbal Responses
	Total Percentage Correct	Mean Response Time to Correct Items	Percentage Correct for Yes Items	Mean Response Time for Correct Yes Items	Percentage Correct for No Items	Mean Response Time for Correct No Items	
Two	89.6	2.80	94.2	2.49	85.0	3.25	1.25
Three	97.9	1.75	96.3	1.65	99.6	1.85	1.0
Age Effect	F =14.12 p <.001	F =1.60 N.S.	F = .77 N.S.	F = .95 N.S.	F =12.08 p <.01	F =3.16 p <.10	F = .02 N.S.

	Production ^b					Number of Production Responses on Verification List
	Total Number of Responses	Mean Response Time For First Responses	Mean Response Time For All Responses Following the First	Number of Experimenters Prompts		
Two	3.14	8.20	5.93	2.20	.65	
Three	7.90	6.20	6.35	2.63	1.0	
Age Effect	F =9.87 p <.01	F = .30 N.S.	F = .09 N.S.	F = .38 N.S.	F = .47 N.S.	

^a All response times are given in seconds.

^b All production dependent measures are based on those subjects who produced at least one response; seven two-year olds and ten three-year olds.

age, although the increase appeared to be due to the ability of the older children to more successfully reject inappropriate items. Older children were correct more often on "no" items than younger children, but no age differences occurred in correct responding to "yes" items. Overall, the rapidity of response time decreased significantly with age, but this decrease was largely due to the older children's ability to respond relatively more quickly to "no" items than younger children. No significant decrease occurred in reaction time for the "yes" items. Rejecting inappropriate items was a more difficult task for the two-year-olds in terms of errors made and length of time needed to respond. Two-year-olds may have had a broader concept of what belonged in a kitchen or bathroom and recognized that the item was a peculiar room item, but accepted it as possible anyway which would account for the increase in correct "no" responses with age. Two-year-olds were more diverse in the types of items they gave in the production task than three-year-olds which would support this notion. Katherine Nelson (1978) has also found that young preschool children are more likely than older children to include items in a concept which go beyond the accepted adult boundaries of that concept.

After children gave their answers to the verification queries, they were asked to place the item in the room in

which it belonged. One reason for adopting this procedure was to make sure that children meant what they said. Some children would deny that an item belonged in one of the target rooms and then place it there anyway. If this occurred the experimenter asked the child again if the item belonged there. All children who gave discrepant verbal and nonverbal responses remained with their nonverbal choice and it was counted correct. Four two-year-olds and one three-year-old gave discrepant verbal and nonverbal responses, though the two-year-olds did not commit the error more frequently than the three-year-old. No child agreed that an item belonged in a target room and then placed it elsewhere.

Although it was hoped that a task involving memory for information known by the child prior to participation in the experimental task would elicit fairly high levels of responding, this did not occur, at least at age two. Collapsing across the two lists, three children at this age gave no responses at all; another five gave between one and three; one child produced four responses and the other, seven. The range in two-year-olds' responses was smaller than that of the three-year-olds, which was from one to fifteen responses. The average number of responses given for both lists are presented in Table 15. The three-year-olds gave approximately twice as many responses as the younger children. When

two-year-old children were able to recall at all, they were still less able to remember than three-year-olds. Even though two-year-olds could recognize over 20 items as appropriately belonging in the kitchen and knew no less than the three-year-olds, the older children were far more capable of retrieving the information at will. Despite the differences in total number of responses given, no differences occurred between ages in the length of time necessary to produce the items. Neither were reaction times for the first production responses nor any following responses longer at age two than three as might be expected. Even though three-year-olds retrieved more information than two-year-olds, the task still appeared to be relatively difficult if reaction times did indeed reflect cognitive processing. Younger children required no more prompts from the experimenter than older children did.

Correlations among production and verification responses.

One motivation for examining the consistency among correct responses to questions requiring recall or recognition was to determine the relationship between recognition and recall processes. We saw earlier that little consistency occurred between recall and recognition for questions asked at home and that relationship can be examined within the context of the memory task as well. Correlations were calculated between the production and verification task dependent meas-

asures and appear in Table 16. For two-year-olds, providing a high number of correct responses in the verification task was not related to any of the other measures except number of correct no responses. As indicated previously, it was apparently fairly easy for two-year-olds to respond yes to the verification items and more difficult to correctly reject an item which did not belong in a particular room. In fact, only correct no responses increased with age suggesting that this was more difficult. For the two-year-olds the children who produced the most correct responses did so because they were capable of correctly rejecting inappropriate items. There was a tendency for children who performed well on the verification task to also produce more responses in the production task; however, this correlation fell short of significance ($r = .41$, $p < .15$). This indicates that although children gave evidence of knowing that various items belonged in particular rooms of a house, they were unable to effectively retrieve the right information in response to a request to do so. Again we see that the young child has tremendous difficulty retrieving at will what he has stored in the contents of his memory.

Responding quickly or slowly to verification questions did not predict the ultimate number of correct responses in the verification task, overall responding in the production task, or production reaction time. Children who were slower to respond in the verification task did require more prompts

to give their responses in the production task. Since the number of prompts was not related to the number of production responses given, this correlation might reflect a style of interaction rather than cognitive processing. That is, children who were either reticent or uncooperative would be likely to produce their verification answers slowly and require extensive prompting in the production task. There was also a trend toward a positive correlation between prompting and length of time to provide the first production response. Again children who responded most slowly required the most prompts. There was no relationship between the time taken to give the first production response and those that followed; however, the longer the child took to produce the first responses the more responses were produced overall. If retrieval of specific information is as difficult as it appears to be, the very young child may need more time to activate or effectively utilize available retrieval processes. Children who take longer to search their memories when first asked the question may be activating an entire domain of information and then selecting responses from that domain. Children who respond quickly may be only activating one piece of information rather than searching the network before responding. In the first case more responses would be retrieved than in the second.

For three-year-olds, overall number of correct verification responses correlated positively with correct yes responses showing that children most often correct were best able to accurately judge that certain objects belonged in certain rooms. For two-year-olds, overall correct responses were correlated with number of correct no responses rather than correct yes responses. As noted earlier, correctly rejecting items was a more difficult task for the younger children, and those more able to do so performed the best overall. Again, there was a strong tendency for overall verification performance to be related to that of production; however, the correlation only approached significance. Nevertheless, the number of production responses given was related positively to the number of correct no responses. Thus, children who were best able to reject inappropriate items also recalled more room items. The two-year-olds' data strongly suggested that this rejection process is more difficult for young children. Thus, recall, which also appears to demand a great deal of cognitive effort may be expected to be correlated with this rejection process for three-year-olds. A negative correlation was found between correct no responses and production reaction time to the first response indicating that children who were most successful in rejecting inappropriate items responded most quickly in giving their first response in the production

task.

Providing production items that were on the verification list was related to receiving a greater number of prompts and to longer reaction times for production responses following the first. Thus children who may have had problems in retrieving items, as indicated by the longer reaction times and more prompting, may have been more likely to retrieve items from the more immediate episodic context of the verification task. Finally, as with the two-year-olds, there was a positive correlation between number of prompts given and response time to first items. If children were taking longer to activate effective retrieval processes, the experimenter would be likely to prompt more frequently.

Relationship Between Memory Performance and Questions Asked at Home

A central question of this study has been whether mothers influence their children's memory performance by making certain memory demands, in this case by asking various kinds of questions. In order to answer this question, the percentages of mothers' speech which were the event and knowledge questions and the percentages of total questions asked which were the event and knowledge questions were correlated with verification and production performance. These two sets of analyses in general yielded parallel

results. Thus, the percentages of total mothers' speech representing the event and knowledge questions are reported and when discrepancies between the measures occurred, the differences are noted. In Table 17 the correlations between verification and production performance and mothers' asking of event and knowledge questions are provided.

As noted earlier, the performance of the two-year-olds in the production task was uniformly very poor which made it difficult to detect relationships between the home and the laboratory measures. One factor contributing to these low levels of responding was poor adjustment to the laboratory setting. Several children cried or were very uncooperative even in the verification task. Clearly we did not have great success with these children in the memory tasks. Given this level of performance it is not surprising that in general for two-year-olds that no relationships occurred between mothers' questioning style and production or verification performance. The one exception was a negative correlation between wh-event questions and total correct on the verification task which was clearly opposite to expectation. This indicates that children who were receiving the most questioning at home were those who performed most poorly in the verification task. Given the problems involved with the tasks, it is unclear whether this negative relationship is an interesting one. In general, then, for two-year-olds, little detectable consistency occurred between home and

TABLE 17

SIGNIFICANT CORRELATIONS BETWEEN PROPORTION OF MOTHERS' SPEECH
INVOLVED IN QUESTIONING AND MEMORY PERFORMANCE

	Total Knowledge Questions	Wh- Knowledge	V- Knowledge	Total Event (Without Clar)	Wh- Event (Without Clar)	V- Event (Without Clar)
Two-Year Olds						
Verification						
Production					-.55*	
Three-Year Olds						
Verification	.60*	.66*	.43+	.72**	.65*	.72* .64*
Production				.46+	.60*	.50+
p < .10+						
p < .05*						
p < .01**						

laboratory measures.

The data for the three-year-olds contrasts sharply to that of the younger children. For production, the number of responses given was correlated significantly and positively with the proportion of mothers' speech dealing with event questions, although this correlation was much stronger if the frequency of asking clarification questions was subtracted. Apparently asking clarification questions was not positively associated with high production performance. When the event questions were separated by type, those demanding recall and those demanding recognition, only questions dealing with events other than clarifying recent language were positively correlated with production responses and question type was unimportant. If the number of questions asked about ongoing events were also subtracted, the strength of the correlation between asking verification event questions and production increases ($\underline{r} = .68$, $\underline{p} < .05$). The number of correct verification responses was positively related to the proportion of mothers' speech concerned with all types of questions, except wh-event; however, if clarification questions are subtracted this correlation too increases ($\underline{r} = .50$, $\underline{p} < .10$). In contrast to these effects no significant relationships were noted between the proportion of knowledge questions and production responses.

To better understand the relationship between mothers' questions and memory performance, the event and

and knowledge categories were divided into sub-categories and each was correlated with verification and production performance. These data appear in Tables 18 and 19. The types of questions which would be likely to "exercise" memory abilities would be those dealing with events in the distant past and questions which would not achieve this would be those dealing with ongoing or recent past events. As can be seen from Table 18, these patterns did occur. Frequent questions dealing with past events occurring before the observations began, within the total observation period, and those that occurred more than once in the past, were predictive of high level production and verification performance. Negative or no correlations occurred between asking questions about ongoing or recently past events. Production and verification performances were also correlated with the proportion of total questions asked that were of each category type. For the most part, the pattern of results was very similar to that given above. The exceptions showed a more strongly negative relationship between memory performance and questions about present events. The more questions, of all questions asked, that were y-clarification questions the less likely that good production ($\underline{r} = -.75$, $\underline{p} < .01$) or verification ($\underline{r} = -.67$, $\underline{p} < .05$) performance resulted. One other type of question important in memory performance was conditional questions. These questions were of the form, if x happens, then y happens and thus dealt

TABLE 18

SIGNIFICANT CORRELATIONS BETWEEN PERFORMANCE ON MEMORY TASKS AND
(A) PROPORTION OF MOTHERS' SPEECH REPRESENTING EVERT CATEGORY
QUESTIONS AND (B) PERCENTAGE OF QUESTIONS ANSWERED CORRECTLY

Proportion of Mothers' Speech	Ongo		Fut Imm		Past Imm	Within Sess		Fut		Bef Sess		Total Sess		Other Remote		Habit		Reason		Cond		Fic Past		Clar		Other			
	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	
TWO YEAR																													
Verification																													
Production																													
OLDS																													
THREE YEAR																													
Verification																													
Production																													
OLDS																													
Percent Correct																													
TWO YEAR																													
Verification																													
Production																													
OLDS																													
THREE YEAR																													
Verification																													
Production																													
OLDS																													
P < .10+																													
P < .05*																													
P < .01**																													

$p < .10+$
 $p < .05*$
 $p < .01**$

TABLE 19 -
SIGNIFICANT CORRELATIONS AMONG PROPORTIONS OF MOTHERS' SPEECH
CONSISTING OF KNOWLEDGE CATEGORY QUESTIONS AND PERFORMANCE
ON PRODUCTION AND VERIFICATION TASKS

	Object Name		Person Name		Actions		Location		Object Properties		Age		Category Membership		Social Routine		Object-Count		Object-Comparison	
	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V	Wh	V
TWO YEAR OLDS																				
Verification																				
Production																				
THREE YEAR OLDS																				
Verification																				
Production																				
THREE YEAR OLDS																				
Verification																				
Production																				

P < .10+
P < .05*

with events that had occurred often enough in the past for the child to know when it was likely that these events would or could occur again. Again, frequent questioning about past events was predictive of good memory performance.

Overall, questions concerning object and symbol knowledge did not correlate as well with memory performance as did event questions. Higher proportions of speech devoted to wh-knowledge questions was correlated positively with verification performance and v-knowledge questions marginally with production performance. When the knowledge category is broken down into its subdivisions the reasons for these correlations become clearer. Several categories correlated positively with verification performance and because name and location questions comprised a large proportion of the total number of knowledge questions, the overall correlation is not surprising. Only four types of questions significantly correlated with production performance, although if production performance is correlated with the proportions of total questions asked representing each category subdivision instead of the proportion of total mothers' speech, other correlations emerge in addition to those already noted: wh-object properties ($\underline{r} = .56$, $\underline{p} < .05$); wh-personalized object ($\underline{r} = .50$, $\underline{p} < .10$); v-inferences ($\underline{r} = .58$, $\underline{p} < .05$).

In some ways, not finding correlations between production performance and knowledge questioning is surprising.

Presumably such information was likely to have been specifically taught and retrieved many times--more akin to rote memory procedures. Because the memory task in the laboratory dealt with information from the knowledge base, this type of demand might be expected to be related to memory skills important in the production task. Why would questions about past events correlate with production performance and not many types of knowledge questions? Perhaps, as suggested earlier, if this information were learned and rotely retrieved, specific associations between questions and answers may have been built up, requiring little memory searching for the response when the stimulus (question) was presented. Questions about events, however, would more likely be unique every time they were asked and would require the child to be creative in his retrieval processes in order to produce the desired information. Even if he were unsuccessful in doing so, the experience of dealing with unique types of information may be very important. Note as well the types of questions asked in the knowledge category which were predictive of good memory performance. Most of these categories involved information rooted in a unique past context or involved information probably not stored directly in the knowledge base. For example, in general all questions dealing with information about a particular object experienced in the past, and to a lesser degree, future contexts (category past and future); questions about fantasy

sequences involving objects usually occurring in the immediate past (object-pretend); questions about objects which were designated as a part of a past event (personalized-object); and questions requiring the child to put together pieces of information and inferring the relationship all correlated with production performance (inference). One category, wh-object properties, which did correlate with production seems to be more of a rote category since one property of objects, color, was a frequent source of questioning and likely to be specifically taught; however, many colors exist as well as many other properties such as size, shape, sound, texture, general appearance, and smell which represent a large domain from which to choose questions. Thus, there was more of a limit on the information which could be queried, but much diversity and uniqueness still remained in the types of questions asked. In addition, it would be unlikely that a mother would ask about the same color or size of the same object each time a property question occurred. Furthermore, few correlations occurred between production performance and questions dealing with counting or social routines, repetition of symbols (letters, numbers, words) or repetition of songs, television materials, or books. As noted earlier, several "rote" and "non-rote" category questions were correlated with verification performance. This suggests that: ques-

tions concerning well-practiced information were important in memory performance at some level; verification requires the utilization of fewer retrieval mechanisms than production; and retrieval involving well-practiced information was related in some way to retrieval skills in verification tasks but not necessarily production tasks. These distinctions between rote and non-rote categories are not that well defined, especially when the correlations between asking the various types of questions are re-examined. Mothers did not exclusively ask questions of one type or the other and memory performance was not exclusively predicted by one type or the other. Further research will be needed to determine the role of asking questions dealing with well-practiced and unique types of information in memory development.

Memory Performance and Proportion of Questions Correctly Answered

Although relationships did emerge between memory performance and the asking of questions, few relationships occurred between memory performance and the percentage of questions answered correctly at home for both two- and three-year-olds. The percentages of questions answered correctly for both the event category and the knowledge category as a whole were correlated with verification and production performance at each of the two ages. The only significant

correlation to emerge from that analysis was a negative relationship between answering verification event questions (with clarification questions included) and verification performance for three-year-olds. When clarification questions were subtracted from the total, this correlation was not significant. Thus, from these data it appears that little consistency occurred between memory performance in the lab and at home.

While correlations between lab performance and correct answers to the knowledge and event questions as a whole did not yield significant results, it was possible that correct responding to particular category subdivision questions was more strongly related to production and verification performance. Correlations between memory performance and correct responses to event category questions can be seen in the lower part of Table 18 and correlations between memory performance and correct responses to knowledge category questions can be seen in Table 20. Of course, only subjects who were actually asked the particular types of questions were included in the analyses. For some question types, few instances of asking those questions occurred and as a result, very few subjects would be included in the analyses. When less than five children were asked a particular question type, the relationship between proportion correct and memory performance was not examined. Event-question categories

excluded from these analyses were conditional and fictional past (Table 18). Knowledge-question categories excluded from these analyses were age, object-comparison, object-pretending, object-count, inferences, games, symbols, and non-verbal actions (Table 20).

While more significant correlations emerged between verification and production performance and correct answers to event category questions than correct answers to correct knowledge category questions, no consistent positive relationships occurred. Thus, the relationship between lab performance and home performance was not stronger as a function of examining the correct answers given to the various types of event and knowledge questions.

Correlations may not be the best way of examining consistencies between responding at home and in the lab. While it may be that children who provide the most responses in the production task are able to respond at a high level at home, children who perform poorly in the lab might not be expected to do poorly at home as well. Presumably it is more difficult for the young child to perform efficiently in a strange environment, with new people, answering unfamiliar questions with no meaningful communicative context supporting the activity. Thus, some children may consistently have difficulty in retrieving information at home and in the lab, but others may do well in a meaningful and support-

ive context at home and poorly in the laboratory without this support. Correlations would not necessarily reveal these patterns of consistencies. Thus, there may be three types of performance: consistently good, consistently poor, or good at home but poor in the lab. The fourth possibility, poor at home but good in the lab, would seem less likely if supporting context is important in aiding retrieval. Presumably the meaningful context would be provided at home and not in the laboratory. The consistency of performance at home and in the laboratory was further examined by considering the proportion of correct responding given to all wh-questions asked at home and performance on the production task. Means were calculated for both measures. If a child performed above the mean on either measure, a plus was assigned for performance on that measure; if performance was below the mean, the child was assigned a minus score. The numbers of children falling into the four possible patterns of responding were counted. At age two, three children responded consistently well; four children responded consistently poorly; two children responded well at home but poorly in the lab; and one child responded poorly at home but well in the lab. At age three, three children responded consistently well; two children responded consistently poorly; two children responded well at home but poorly in the laboratory; and three children responded poorly at

home but well in the lab. At both ages approximately half of the children were responding consistently in both settings. Of those who were inconsistent, however, it was no more likely that good performance occurred at home than in the laboratory. Clearly the "unlikely fourth possibility" occurred fairly frequently, especially among the older children. Thus, the context of the home environment was not the primary factor in whether children retrieved information when requested to do so.

Expecting consistencies between correct responding to questions asked at home and in the lab may just not be valid. The function of the questions may be entirely different. As suggested earlier, at least some types of questions asked at home may be asked to challenge the child. Thus, the information asked for may not be readily known to the child and the mother may be asking the question primarily for instructional purposes. That is, she may ask questions to find out what the child does not know and then give or teach him the information. Not answering correctly, then, would not necessarily be indicative of poor retrieval skills, if the information asked for is relatively difficult or unfamiliar to the child. Conversely, the questions asked of the children in the lab were designed to tap information that the child would be highly likely to know. Difficulty in answering these lab questions would be more likely to reflect retrieval difficulties. Consistencies in performance in the

two settings, then, would not necessarily be expected.

Interpretation of Relationship Between Mothers'
Questions and Children's Performance

What is the significance of the relationships observed between mothers' questions at home and memory performance in the laboratory? Causation cannot be inferred from correlational data, of course; however, possible explanations for these patterns of results can be explored. One explanation is that mothers who have children who remember information well are likely to ask them more questions than mothers whose children do not remember well. Because these questions occurred within a communicative context and one goal of communication is to motivate a dialogue rather than a monologue, one is likely to explore topics which can be responded to effectively. It would seem likely, then, that children who did not remember information would not be likely to answer questions, and thus mothers wouldn't ask them. If this were true, mothers who asked more questions would have children who gave more production responses. Thus, mothers were not influencing memory development but being influenced by it.

If mothers' questions were influenced by the children's memory abilities, then these questions could have to be related to the child's ability to answer the questions correctly, if answering the question correctly was a valid measure

of memory ability. Correct responding to questions would then have to be correlated with memory performance in the laboratory. Few significant positive correlations occurred, however, between memory performance at home and in the laboratory. Furthermore, mothers' questions did not in general correlate with the child's ability to answer the questions, and when these correlations did occur the type of question involved did not correlate with production or verification performance. Thus, the child's ability to answer questions could not have mediated the correlations observed between mothers' questions and children's production and verification performance.

Nevertheless, as indicated previously, children's responses to questions may not be a good measure of memory ability, thus making this argument invalid. Another measure of memory ability at home, such as spontaneous recall not in response to questions, may be more appropriate. If this measure did correlate with the asking of questions, then it could be argued more strongly that the child's memory ability influenced the types of questions mothers asked. Even so, it could be further argued that spontaneous recall abilities were influenced by mothers' questions asked at an earlier time.

Although mothers may not seem to ask questions in response to the child's home memory ability, other competencies of the child could be mediating the correlation between

frequency of questioning and memory performance in the laboratory. One other ability which would seem likely is productive language ability. MLU was correlated with asking several types of questions which correlated with production and/or verification performance such as total session, social routines and games; however, MLU was not correlated with verification or production performance, so language ability cannot be responsible for the effect either. There are undoubtedly many of the child's behavior which could be mediating the correlation between questioning and memory performance, but these obvious candidates failed to account for this relationship.

Another possible reason for these observed relationships is that mothers who ask many questions are making many demands for retrieval; retrieval demands are important in training the child to use and develop his memory; children who have been exposed to these environmental demands have better memory abilities and thus remember more in the memory task. It is this explanation which is central to the Soviet perspective on memory development, and at the very least, the hypothesis cannot be rejected since evidence consistent with the perspective was in fact found.

If it is accepted that memory demands do influence memory performance, meeting these demands apparently is less or not important in this process. A second implication of

the failure to find a correlation between memory performance in the lab and at home was that successfully retrieving the correct information is not terribly important in memory development. Perhaps if the answer is too easily found, the child is not using new techniques to get at the information. A mother who frequently asks questions the child has difficulty answering appears to be challenging her child in useful ways. Exactly how this occurs remains unclear.

At least one other important issue remains which has not been discussed thus far in relation to the production task data. Although the level of memory demands did seem to positively influence the memory performance of the three-year-olds, can the level of memory demands account for the increase with age in the ability to recall information? The answer appears to be no. Neither the increase in laboratory or home memory performance can be accounted for. First of all, the data from the two-year-olds were confusing. Perhaps two-year-old social behavior interfered with demonstrating the memory abilities of which they were capable. Or perhaps the task was not a good one for them. At any rate let us assume for the sake of argument that memory demands did influence memory performance but for some unknown reason this relationship wasn't demonstrated. In order to be consistent with the idea that higher levels of memory demands lead to greater memory capabilities of some types then an increase in memory

demands in either quantity or quality with age would need to be observed. Was it? It is true that mothers of two-year-olds asked proportionally fewer event questions of their children than mothers of three-year-olds. From the data it appears that retrieval memory demands concerning events influence memory performance much more strongly than knowledge questions. Therefore if the type of question which influences memory performance is asked more frequently with increasing age and memory performance increases with age, it appears that greater memory demands with age could at least in part account for the age trend. Upon closer examination of the event category, however, it is not clear that this claim is warranted. The only major event subdivision which significantly increased with age was the asking of clarification questions, which did not correlate with memory performance at age two or three. Conditional event questions did increase with age and did correlate with memory performance at age three; however, this type of question comprised at most only one percent of the questions asked and cannot be seriously considered as the mechanism of memory development. Overall, then, the level of memory demands did not increase with age. The design of the study undoubtedly contributed to the failure to find increasing memory demands with the age of the child. There was a great deal of variability among the mother-child pairs studied and the cross-sectional design

employed in the study did not help to reduce that variability. As pointed out earlier, a longitudinal study is really needed to evaluate this issue. A longitudinal study might also help to untangle the issue of whether mothers influenced memory development or were influenced by it. Perhaps, though, environmental demands just aren't primarily responsible for increasing memory abilities with age. From the present data, differences among children at one age level may be linked to varying levels of memory demands but to assume that environmental support is the primary mechanism of memory development may be too extreme. The alternative, of course, is that an innate, biological program operates which causes memory capacities to increase or allows strategies to be learned which increases this memory capacity. Normal environmental stimulation is necessary to keep the program in operation and various types of stimulation allows development to proceed beyond what nature provides on its own.

Relationships Between Memory Knowledge and Performance

In addition to exploring the nature and importance of memory demands in the form of questions that mothers asked their children, any direct references to memory or remembering, were examined. Perhaps determining how the word "remember" was used as well as how often, what information was given to children about remembering and what children them-

know about memory may provide useful information about memory processes, memory performance or both.

Interestingly enough, the word remember was used very infrequently, although in a consistent way. The number of times that remember was used in reference to the child's remembering either in a question (e.g., "Do you remember going to Grandma's house?"), statement (e.g., "You remembered that."), or instruction (e.g., "Remember to get your belt.") format was 12.8 for two-year-olds and 9.2 for three-year-olds, which was not a significant difference between the two ages. At each age, however, remember almost always appeared in a question as do you remember x (11.7 vs. 7.8 times). Furthermore, when remember was used in a question it appeared more often in an event than a knowledge question. At age two remember appeared in an event question 8.5 times and in knowledge questions 3.1 times ($t(9) = 4.18, p < .01$). At age three remember was used 4.9 times in event questions and 2.8 times in knowledge questions ($t(9) = 1.95, p < .10$). Mothers were not typically observed to instruct the child to specifically remember something for a future time. Children, then, heard the word in its retrieval sense far more often than in its encoding sense. This is interesting in light of the fact that when young children are told they will be expected to remember a set of pictures, objects, or words they perform no differently than if they have been told simply to look at the to-be-remembered items (Appel, Cooper, Yussen,

Sims-Knight, and Flavell, 1972). Young children may only know the word remember in its retrieval sense and not realize they are being told to perform some special behavior. On the other hand, young children may have problems planning ahead in memory tasks. That is, they may find it difficult to perform a certain set of behaviors (encoding and maintaining strategies) now, for a particular event to occur in the future (recall). Indeed, young children have been found to develop retrieval strategies before those for encoding (e.g., Myers and Perlmutter, 1978) which further suggests that planful behavior is very difficult. To plan ahead, some knowledge of future requirements must be attained. Mothers may be sensitive to these difficulties and only use remember in its retrieval sense.

Although there were no differences between the two ages in how often the mother used the word remember, there were two other changes in word usage with age. Mothers of three-year-olds were more likely to talk about their own remembering than mothers of two-year-olds (2.5 vs. .6, $F(1,19) = 6.93$, $p < .05$) and three-year-olds themselves were more likely to use the word remember than two-year-olds (1.80 vs. .3, $F(1,19) = 7.31$, $p < .05$). Apparently mothers viewed talking about their own memories as being of less interest to younger children or more difficult to understand. Greater use of the word by older children may reflect their growing

abilities to remember or a better understanding of the word. Similarly to mothers, however, children only used the word to indicate that they remembered something or to ask if another person (mother or sibling) remembered some piece of information.

Frequency in using the word forget was also examined, however, no differences occurred between ages in mothers' or children's use of the word.

The conversations between mothers and children were closely examined for instances of information given or asked for by mother or child about memory. The number of sentences involved in exchanges concerning memory were counted; however, such occurrences were extremely rare and no differences between ages were observed in the measures. Examples of instruction on the part of the mothers to aid recall included one mother's description of how to generate a mnemonic device to remember a particular actor's name the child was fond of and another mother's instruction to put the child's boots by the door so he would be sure to wear them when he went outside. Thus, occasionally mothers did provide information on how to best use memory abilities. Children even less often demonstrated any knowledge or sensitivity to memory processes; nevertheless, one two-year-old boy, upon the unexpected return of his father after leaving the house for work, asked "What Daddy forgot?"; and a two-year-old girl asked her mother to call the family dog into the house so she

could draw a picture of him. Needless to say, these examples, though rare, were an impressive indication of even two-year-olds' knowledge of memory-related situations.

Learning about memory clearly begins at a very early age.

Even though the occurrence of specific memory-related events did not appear often, it was of interest to discover if these occurrences related at all to verification and production performance. In fact, because of the low frequency of memory-related events, overall, children who did have instruction about or knowledge of memory's situations may indeed be those children who performed well on the memory tasks. In Table 21, correlations are listed between the specific memory home variables and memory performance in the laboratory.

For two-year-olds, no relationships occurred between the memory-knowledge variables and production and verification performance, except one. The child's memory performance did not correlate with mother's use of the word remember in relation to her own or her child's memory nor with the display of child or mother metamemory. Furthermore, in contrast to what might be expected, the one significant correlation between child's use of the word remember and memory performance indicated that children who used the word remember the most at home were those who recalled the least in the laboratory and those that used the word the least at home

recalled the most in the laboratory.

For three-year-olds, however, several interesting correlations occurred between the two sets of measures. The frequency of the child's use of the word remember was positively correlated with both verification and production performance. Interestingly enough, there was a trend toward a negative relationship between using the word forget and memory performance. This is the first suggestion of some consistency between home and laboratory memory performance. Frequent use of the word remember on the part of the child may reflect frequent instances of spontaneous recall. That is, children who use the word the most may be the children who are remembering the most on their own and not in response to questions by the mother. Conversely, frequent use of the word forget may reflect a child who does not remember well or who refuses to try to retrieve information and simply says "I forget." If this were true, however, why spontaneous recall would correlate with memory performance in the lab and not retrieval in response to questions at home is unclear, unless children were not very motivated to answer their mothers' questions or questions asked were too difficult to answer. Further examination of the data will be needed to determine the nature of the relationship between spontaneous recall and retrieval in response to questions at home and in the laboratory.

Mothers' use of the word remember also correlated with the child's memory performance, but only if used in certain ways. Using remember in questions frequently, correlated positively with both verification and production performance, while using the word in a sentence, which described the child's memory, correlated only with verification. No correlations occurred between instructing the child to remember or describing the mother's remembering and the child's memory performance. Mother's use of the word remember in a retrieval sense also correlated with the child's use of the word ($r = .82, p < .002$).

Perhaps frequent use of remember in a question format provides the child with an understanding of the concept "remember" in its retrieval sense or at least frequent use reflects a mother who in other ways is communicating what it means to remember. Indeed, mothers' use of the word correlated with the child's use in frequency and in the way it was used (event retrieval). Children may have been learning what it means to remember and their knowledge may have positively influenced their recall in some way. This implies that implicit knowledge of the concept may influence memory performance, especially since explicit statement of memory knowledge on the part of mother or child did not correlate with the child's memory performance. Thus, there may be a complex learning process involved in knowing what it means to remember which is reflected in recall abilities in some way.

Because remember was most frequently used when asking event questions and asking event questions correlated positively with memory performance, the correlation between mother and child's use of the word remember and memory performance may be mediated by the frequency of asking event questions. Furthermore, since the child's use of remember was positively correlated with mother's use, the correlation between child's word use and memory performance may also merely reflect the correlations between question asking and performance. Indeed, frequent use of remember was correlated positively with the proportions of mothers' speech that were wh-event questions ($r = .53, p < .06$) and y-event questions ($r = .81, p < .002$). To better assess why these relationships may be occurring production and verification performance was correlated with mother and child's use of remember controlling for the proportion of mothers' speech which involved event questions (with clarification questions). None of the correlations were significant except for a marginally significant correlation between production performance and the child's use of the word remember ($r = .48, p < .10$).

These findings, however, suggest how using the word remember could influence memory performance and why event questions were so important in influencing laboratory memory performance. Not only may event questions be important in encouraging the creative retrieval of information, but also

such questions may provide the child with an understanding of the concept to remember since remember most frequently occurs in the context of event questions. Creative retrieval abilities and exposure to the concept remember may be important in the child's use of the word and his own recall. Finally, spontaneous retrieval abilities, at least partially developed from his experience with event questions, may be related to retrieving knowledge from long-term memory when he is motivated to do so.

These results suggest that memory knowledge in some way may influence memory performance, but the evidence is not strong and how this might occur is unclear. Mothers and children rarely were observed describing or demonstrating memory-related knowledge which undoubtedly made it difficult to detect relationships between memory knowledge and performance. This evidence does not support the notion that a relationship exists between metamemory and memory performance, although these procedures did not necessarily provide a strong test of the relationship either.

CHAPTER IV

SUMMARY AND CONCLUSIONS

Vygotsky's socio-historical theory of cognition has important implications for the study of children's memory development. Cognitive processes are thought to develop in the context of social interactions between parents and children and in response to the demands of that context. Empirical support for these ideas had not been previously provided, however. Thus, the purpose of this investigation was to evaluate some of these ideas in the context of studying the development of memory. The nature of and changes in early memory demands were examined as well as the relationship between memory demands and memory performance. Memory demands were found to occur and these demands were related to memory performance, establishing preliminary support for Vygotsky's theory.

Observational Findings

Memory demands chosen for study were the questions mothers asked their children and knowledge about memory functioning mothers conveyed. Questions were found to be fairly frequent in mothers' speech and were categorized as dealing with two types of information: event and

knowledge. About twice as many event and knowledge questions were asked at both ages; however, the proportion of mothers' speech comprised of event questions increased with age and the proportion of mothers' speech comprised of knowledge questions decreased with age. The increase in event questions seemed largely due to an increase in asking questions concerning the repetition or clarification of what the child had just said. The decrease in knowledge questions appeared largely due to the decrease in asking questions concerning the names for objects. Although there were changes with age, then, in the proportions of event and knowledge questions asked for the two categories as a whole, these changes did not occur across all questions asked making up the larger categories. Thus, there did not appear to be dramatic changes with age in the types of information children were asked to retrieve.

At both ages a large proportion of the event questions asked dealt with events just taken place, currently happening, or which were to occur momentarily. Some mothers, however, were found to consistently broaden the context of their questions to past and future events which were removed from the present in time and/or space. Questions dealt with events that had occurred one hour to one year before the question was asked. Even young children, then,

were expected to remember information from the quite distant past and to recall it in response to these specific questions.

Mothers who questioned their children frequently about events were likely to also ask many questions concerning knowledge of objects, symbols, and routines. In contrast to the event questions, the types of information sought in the knowledge questions appeared to be more diverse. A greater number of categories was needed to describe the nature of the knowledge questions. Among the questions most frequently asked, names, locations, and properties of objects and people, mothers who asked many of one type were found to ask many of the others. Other less frequently asked questions, which involved information about objects experienced in particular contexts, were also consistently asked by some mothers. This tendency for mothers to consistently ask less frequently occurring questions appeared to be stronger among mothers of older children, which suggested that these questions concerning objects in context may have been more difficult. Questions about objects which are contextually specific may be more demanding on retrieval skills than questions concerning stable characteristics of objects which remain invariant across contexts. For example, if the child is asked

a question about a dog that was brought to his house one day by a friend, he might have to search stored instances of the friend's visits and/or the events that occurred on that particular day in order to remember the particular dog. In contrast, to provide a name for a picture of a dog, the child might only search one concept node for the name. A dog is called dog across most contexts. This is not to say that context does not influence the names by which we call things, only that the names for a general class of things is less context specific than information about particular objects in particular contexts.

The forms that these questions took did tend to vary with the information asked for and the age of the child. At both ages, knowledge questions were asked more frequently in the wh than verification form. This suggested that mothers and children had developed question-answer routines about objects in which specific answers were expected in response to specific questions. For event questions, two-year-old children were asked more verification than wh questions, while at age three, there were no differences in mothers' asking wh and y questions. Questions about events may have been asked to obtain information which the mother wanted in order to maintain a conversation or which she truly needed about the child's activities, and were

not necessarily asked to test the child in what he knew. If event questions were primarily asked to help maintain conversations between mother and child, then the greater number of event questions asked at both ages noted previously, was not surprising. Hypothesizing that the event questions were useful in maintaining conversation also suggests why mothers asked younger children more event questions in the verification than wh form. If mothers wanted to maximize the likelihood of obtaining an answer from the children to maintain the dialogue, the event question might be easier to understand and possibly answer in the verification than wh form. Indeed, the younger children's greater difficulties providing information when asked wh-questions may have prompted mothers to ask more verification questions. Mothers of younger children may have also been relatively more concerned with instructing the child than mothers of older children, which could explain the decrease with age in the number of wh-knowledge questions asked. Mothers may have believed that older children were more capable of answering these questions than younger children (as they were indeed found to be) and thus were more likely to ask wh-questions as frequently as verification questions. Perhaps, too, because the major increase in asking wh-questions was a

result of asking more clarification questions, mothers may have asked more wh-event questions in response to the child's linguistic competencies.

Striking differences between the two age groups, then, did not occur in the types of questions asked and the frequency of asking them. Although there was a tendency for mothers of older children to ask more event questions than mothers of younger children, this increase largely occurred due to mothers' asking more questions of only a few types. Mothers, then, did not uniformly require more memory processing of older than younger children by demanding more recall than recognition, by demanding the retrieval of perhaps more difficult information, or by demanding retrieval of information more often. Age-related increases in memory ability observed in the production task in this study, then, cannot be attributed to increasing memory demands with age.

The cross-sectional design of this study may have interfered with observing age changes and thus a longitudinal design may be more useful in assessing developmental increases in memory demands. Perhaps as well other memory demands not examined in this study, such as providing information to the child which is to be remembered, would

be found to increase with the child's age. On the other hand, memory demands may not be primarily responsible for age-related memory changes and may better account for differences among children at one age. That is, as long as adequate environmental stimulation is provided, development of memory abilities may proceed; however, environmental stimulation above a base level may lead to higher levels of memory functioning in one or more domains at one particular age.

In general, questions were not answered correctly very frequently at either age. Either children were not motivated to answer these questions, mothers typically asked difficult questions, children were not easily able to retrieve information they knew when specifically requested to do so, or some combination of all three. At both ages verification questions in the knowledge category were more frequently answered than wh-questions; however, only the two-year olds answered more verification event than wh-event questions correctly. The ability to answer wh-event questions correctly increased between age two and three and three-year olds were as successful in answering the wh-event as the verification event questions. The specific types of questions more easily answered at age three in the event category were

future, total session, habitual event, conditional, reason, and clarification questions. The age-related improvement that did occur involved providing information about the activities of the child and those around him within a context often replete with possible memory cues. Perhaps, improvement in the more difficult process of recall occurs in relation to contextually-based, action-oriented events. This improvement may occur as a result of the child's increasing abilities to encode contextually-based information more effectively, retrieve such information more effectively, or both. Furthermore, these findings demonstrate that even in situations which are ecologically valid, children do not perform impressively at age two and three. Concern has been voiced that performance on laboratory tasks has been an underestimation of children's memory abilities and that richer behavior would be observed in more naturalistic settings such as the child's home (e.g., Brown, Note 1; Paris, 1978). It appears from these data that this is not necessarily the case. Thus, as long as behaviors investigated in the laboratory have some relevance to cognitive functioning in the "real" world, the use of laboratory tasks seems legitimate for exploring the nature of the young child's behavior.

Consistencies in answering the various types of questions were not strong within the four structure-content question categories; however, among the four, a few relationships were observed. For three-year olds, answering wh- and y-event questions was significantly positively correlated. Also at age three, answering wh-knowledge and y-event questions was significantly positively correlated, and both were negatively related to MLU. Thus, children who were answering the greater proportion of questions correctly were producing the shortest sentences. This result was not expected, although several explanations for the finding were previously discussed. In contrast, two-year olds who were able to answer wh-event questions correctly were likely to answer wh-knowledge questions correctly as well and this relationship appeared to be mediated by higher levels of language ability.

Although mothers frequently asked questions, they provided little knowledge of memory directly to their children. Very few occurrences of describing memory functioning, instructing the child in using memory strategies, or engaging the child in memory games were observed, and their incidence did not increase with age. The use of the word remember, though infrequent, did appear in specific contexts and was thought to perhaps convey some infor-

mation to the child of what it means to remember in its retrieval sense. Remember almost always occurred in the context of retrieval, that is, "Do you remember x?" or "I remember x." It was almost never used in an instruction format in which the child was told to remember to do something. Young children may first learn that remember means to recall and not necessarily to do something now to remember in the future. The observation that children begin to use retrieval strategies before encoding strategies (e.g., Myers and Perlmutter, 1978) reflects the notion that memory is understood in its retrieval sense before its encoding sense.

Relationships Between Home and Laboratory Measures

A major focus of the study was whether the types of questions asked by mothers at home and the frequencies in asking them would be related to performance on the verification and production tasks conducted in the laboratory. At age two, neither the rate with which questions were asked nor the types of questions asked were significantly correlated with either verification or production performance, except for a negative correlation between wh-event questions and production. Two-year-old children, however, performed uniformly poorly on the production task and were generally uncooperative even in the verification

tasks. Thus, neither task performance varied greatly among the children and as a result, relationships between mothers' questions and children's performance was undoubtedly difficult to detect. Performance on the verification task suggested, however, that the low level of responding in the production task was primarily due to difficulties in actually retrieving the information, rather than a result of not knowing the information. In order to suitably test the relationship between memory demands and memory performance in the future, a memory task must be found in which two-year olds are willing to participate and in which a larger range of responses is obtained.

For three-year olds, several relationships were found between mothers' questions and children's memory performance.. When the event and knowledge question categories were considered as a whole, performance on the laboratory verification task was correlated with the frequency of asking both event and knowledge questions, while production performance was related only to asking event questions. Thus, children whose mothers made more memory demands in the form of asking particular types of questions performed better on the memory tasks. Evidence was obtained then, that mothers' memory demands were re-

lated to children's memory performance. Although the correlations between memory demands and memory performance establish that the two are related, it is not clear that mothers' memory demands shaped children's memory functioning. Children's memory abilities may have shaped mothers' demands, or some other underlying factor may have affected both mothers' demands and children's functioning. Nevertheless, the relationship is consistent with Vygotsky's socio-historical theory of memory development which emphasizes the importance of the demands of social interaction in cognitive functioning, and therefore, the theory cannot be rejected. Further work will be needed to establish a cause and effect link between placing memory demands on the child and improving memory functioning. Possible directions for future research to accomplish this will be outlined later.

When the relationships between asking event and knowledge questions and memory performance were examined in more detail for the three-year olds, the asking of particular types of questions emerged as primarily responsible for the correlations. In general, questions dealing with present events were not correlated significantly with production and verification performance or were significantly negatively correlated. Questions dealing with the past (e.g., total session, before session,

other remote past, habit, and conditional) were significantly positively correlated with performance on one or both of the memory tasks. Children whose mothers asked many questions about past events which required retrieval of information about events removed from the present were best able to retrieve information from long-term memory. Children whose mothers asked many questions about present events which required memory retrieval but not for information of events removed from the immediate context, were least able to retrieve information from long-term memory. Therefore, the asking of questions in general is not the important factor in the relationship between memory demands and memory performance. It is the asking of questions concerning past events which requires retrieval of information not recently experienced. Quite specific memory demands, then, appear to be responsible for the relationship between memory demands and memory performance.

Fewer significant correlations between question types and memory performance were obtained when correlations were computed for the knowledge question subtypes. Significant correlations that were obtained occurred more between knowledge question types and verification performance than between knowledge question types and production performance. The significant correlations that did emerge seemed to occur

between memory performance and those questions concerning objects in changing contexts, such as object-pretend, personalized knowledge of objects, and objects experienced in past contexts. Questions dealing with both events and object knowledge in past contexts removed from the present in time and/or space were found to be correlated with memory performance. This evidence indicates that the retrieval of information which is contextually unique involves a higher level memory demand. Children may need to make use of creative retrieval skills to comprehend and answer questions concerned with contextually-bound information. If memory demands do influence memory performance, there is the suggestion that the retrieval of well-practiced information needed to comprehend and answer questions may be useful to some extent in developing memory abilities required in verification tasks, but not as useful in developing the further abilities required in production tasks.

How might the retrieval of contextually-bound information be useful in memory development? In order to retrieve information bound up in a specific context, the child must search many contexts in order to retrieve the target information. The child may not find the right context, but is given practice nevertheless in searching for

the information in various contexts. Few relationships did occur between the percentage of questions correctly answered by the child and memory performance. Thus, if memory demands do influence memory performance, successfully meeting the memory demand does not seem an important factor in developing the retrieval process. If the child can easily provide an answer then it may be that he is learning nothing new about retrieving information. Perhaps searching for information in various contexts provides the knowledge (not necessarily explicitly) that context is an important cue in retrieval. If one can retrieve the context in which an event or object occurs, the specific information needed may be more easily retrievable. For example, in the production task, one useful way of dealing with the task demands is to image or think about one's own kitchen and name things found in that context. Or if one is trying to think about what one did at a particular time, a useful strategy is to think about everything leading up to that event. In other words, one provides an internal context linked to the information being retrieved. Retrieving information in context, then, may be a very important part of the development of the retrieval process. Perhaps being questioned about events and objects in contexts encourages the child to learn about context,

that is, that information should be searched for in various contexts and that internal and external contexts can be useful in retrieval.

The relationships between memory performance, mothers' and children's use of the words remember and forget, and the other demonstrations of metamemory were tested as well. For three-year olds, the number of times that remember was used in a question by both mother and child was significantly positively correlated with both verification and production performance. At age two, these measures were negatively correlated with memory performance. Direct demonstration or instruction concerned with memory functioning was not correlated with memory performance at either age. Therefore, children may have been learning something about what it means to remember, indirectly through their mothers' use of the word in its retrieval sense. Metamemory appears not to be strongly and directly related to memory performance. Rather, Flavell and Wellman's (1977) suggestion that "significant others may actually provide a model of various memory behaviors, but probably more often they are simply providing 'aliments' and demands that shape the child's own thoughts" is likely correct. The correlation found between memory performance and the child's use of remember and forget

suggested that there may have been consistencies between memory retrieval at home and memory retrieval in the laboratory. Children who used the word remember the most often at home were best able to perform on the memory tasks and children who used the word forget most often at home performed least well on the memory tasks. If the frequency in using these words reflected the amount of information remembered and forgotten, then consistencies may have occurred between memory performance in the laboratory and information spontaneously remembered at home. To assess stability of memory retrieval across situations and contexts, the child's ability to spontaneously recall at home should be compared with memory performance in the laboratory situation.

The results of this study complement previous memory research and help to provide a more complete picture of memory development. The memory processing of young preschool children has been described as non-strategic, non-planful, and non-deliberate. Young children's memory has been thought of as primarily involuntary (Yendovitskaya, 1971; Brown, 1975; and Myers and Perlmutter, 1978). These descriptions have been based on research conducted in the laboratory and it has been thought that memory may not be as poorly controlled by children in more meaningful and

familiar settings. This study, however, has shown that these earlier descriptions seem largely accurate. Young children in this study may have demonstrated that they can remember information for relatively longer periods of time than have been shown in the laboratory; however, they did not retrieve this information without difficulty and did not appear to do anything to help themselves in the retrieval process. While mothers did make memory demands, these demands occurred largely as a by-product of normal conversation. Mothers were not frequently observed demonstrating memory related behaviors nor requiring the child to perform behaviors which would help him remember. Whatever the child is learning about memory appears to occur on a relatively subtle level. Mothers may have been conveying information relevant to the development of retrieval and/or exercising memory abilities in useful ways by asking questions requiring retrieval of information in context and by using the word remember in particular ways. The relationships observed between memory demands and long-term memory performance suggested that although environmental experiences may subtly convey information relevant to the development of retrieval skills, this information may be quite effective in developing memory abilities. Children whose mothers made the most memory demands

of particular kinds performed best in the memory tasks. This finding suggests that the social environment may be very important in the development of memory and supports some of Vygotsky's perspectives concerning the development of cognitive abilities.

Future Directions

Stability of individual differences among children over time and the relationship between mothers' questioning styles and children's memory performance at a second later time could be explored by testing the children who participated in this study again approximately a year after original testing. Production and verification tasks could be readministered to the children (perhaps for different rooms) and possibly more standard recognition and/or recall tests of short-term memory could be added as well. Little is known about the stability of children's memory abilities over time. If consistencies in performance were found, suggestive evidence would be provided that memory develops in a continuous way over time and that individual differences are maintained. Perhaps, too, if mothers' demands do influence memory performance, finding consistencies in children's memory behavior would indicate that memory demands are stable over time and/or

affect the child's memory abilities in a consistent manner. Stability in the relationship between mothers' memory demands and children's memory performance would be more directly indicated by finding correlations between mothers' memory demands observed in this original study and children's memory performance at this later, second time. To most directly assess consistencies in mothers' demands, mother-child interactions should also be observed again. This, however, is probably not feasible because mothers, of course, were informed of the purposes of the study at the close of the observational sessions. Therefore, mothers would know that the study was designed to examine memory demands and mothers might change their behavior to please the experimenter. Examining the relationships between mothers' questions and children's memory performance of a year later would be especially interesting for the children who were two years of age in this original study. No relationships between memory demands and performance were found for these two-year olds. If a positive relationship between mothers' memory demands at time one and children's memory performance at time two were found, this would strongly imply that memory demands were influencing memory behavior, and would further support Vygotsky's position.

There are other questions which the data already collected, but not analyzed, could be used to explore as well. The enormous amount of data collected unfortunately precluded conducting analyses relevant to answering these questions in the present study. In addition to examining questions mothers asked, the types of instructions mothers gave and the ways mothers taught their children information could be examined. Both giving instructions and providing new information place memory demands on children which may exercise different abilities than the asking of questions examined in this study. To carry out an instruction, children must remember the information provided long enough to perform the required activity. Thus, children may learn to maintain information in short-term memory or develop ways of having this done for them by having their mothers repeat the instruction or help them perform the activity. It would be of interest to know, then, if mothers of younger children give shorter instructions, repeat them more often, and avoid instructing the children to perform activities far in the future. Providing information to children may help them to develop means of encoding and storing information. Do mothers of younger children provide less information? Are there differences in the types of infor-

mation mothers provide? In other words, are there changes in age in these types of memory demands? Would mothers' frequency of giving instructions or providing of information correlate with children's memory performance? These types of memory demands seem more important in developing memory encoding and storage skills. Perhaps these memory demands would not correlate with performance on the production and verification tasks since retrieval skills were largely involved in these tasks. Answers to these questions would provide information concerning the types of memory demands which are related to memory performance and whether some types of memory demands do change with the age of the child. Again, further information relevant to Vygotsky's theory would be obtained.

Another broad area of research which the results of the present study suggest is important is investigation of the role context plays in memory performance and development. Brown (1975) and Yendovitskaya (1971) suggest that context influences what and how well the child remembers, yet little is known specifically about the effects of context. Further information concerning the role of context can be obtained by examining the transcripts of the mother-child conversations collected in this study for instances of spontaneous recall in children

(that is, recall which is not in direct response to a question by the mother). Are there patterns involved in children's recall? When children remember is the present situation linked in any way to the remembered event? Are specific types of information remembered about events? Answers to these questions would suggest whether the match between external context and internal representation of events is important for remembering to occur and if various types of information are more easily elicited by certain contextual events or settings. More efficient remembering of certain kinds of information, such as actions for example, might indicate that young children have a greater propensity to encode and/or retrieve information of particular types. This encoding or retrieval bias may reflect the nature of the child's overall cognitive development in some way.

If such patterns are found (or even if they are not), experimental investigations could be conducted to establish cause and effect relationships between the external environment and what is remembered. For example, an "event" could be "staged" for children either in the laboratory or the child's home. Persons involved in the event, actions performed, and the location of the event could be varied. Is a child more likely to remember some types of

information about an event than others? Would the child remember more if he were retrieving information about the event in the same place it occurred, if he were doing similar things, or if the same people were present? Are these contextual cues equally facilitative? Does memory for events change over time? If so, do these changes occur for all types of information? Are different types of information remembered longer at different ages?

Evidence supporting Vygotsky's theory that demands made in the context of social interactions influence cognitive functioning has been provided by the present study. However, an experimental investigation must be conducted to provide a strong test of the theory. The assertion that placing memory demands on a child influences memory functioning is clearly an important one. If this were true, the practical applications of such a finding would be far-reaching. Mothers might aid in the memory development of their children by placing certain memory demands on them or preschool programs might be designed to incorporate memory demands to facilitate development. If the child were better able to remember information in certain situations, perhaps the development of attention, language, and problem-solving might

also be positively affected. Thus, an experimental study designed to evaluate the relationship between memory demands and memory performance is crucial. In such a study, memory demands could be increased above a baseline level over a period of time. Memory performance could then be measured before the program of increasing memory demands was begun and after the program was terminated. One and probably two control groups would be needed in the study. One group of children similar to the experimental group in age, socio-economic status, and maternal education would be tested at the beginning and end of the study to control for increases in memory due to normal age-related development. Another group might be desired to control for the effects of increased attention and interaction between mother and child in the question-answer periods. If memory performance increased to a greater degree than that of the control groups who did not receive this increase in memory demands, very strong evidence supporting Vygotsky's theory would be found. Critical information concerning important factors in the processes involved in memory development would be obtained.

The limited success of similar investigations concerned with language development suggest that establishing a cause and effect relationship between memory demands

and memory performance may be difficult. Brown and Bellugi (1964) observed that adult expansions of children's incomplete utterances occurred frequently in adults' speech to children. Expansions were thought to represent ways adults teach their children about language structure. Nevertheless, Cazden (Note 2) did not find that providing expansions facilitated the acquisition of structure. Nelson, Carskaddon, and Bonvillian (1973) did demonstrate that expansions increased children's language ability, but only after 22, 20-minute sessions. Children in the experimental group were more advanced in their language ability than an untreated control group, but did not differ from children who received the same amount of interaction with an adult but no expansions. Conversation with an interested adult may be more crucial to the acquisition of syntax than any particular technique used by the adult. Similar findings may be obtained for memory demands as well. Even if the relationship between memory demands and memory performance is not supported by future experimental evidence however, the true value of the present study will have been to demonstrate that observational research can be extremely useful in raising issues, suggesting new avenues of research, and possibly answering important questions relevant to the

study of memory development. Observational research, especially coupled with experimental tasks and situations, can effectively be used to explore the process as well as the products of memory development.

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